WINTERSOLDIER

The 1997 edition of Wintersoldier complements SoldF (Soldier´s Field Manual) and SoldR Mtrl (Soldier´s Equipment Instructions) providing advice and recommendations for your performance both on and off the winter battlefield. Wintersoldier gives advice to all soldiers involved in national defence.

The cold and snow of winter force you to change your performance from how you would usually react in summer and on bare ground. Weapons, vehicles and other equipment require special attention in winter conditions.

The wide ranges of winter conditions that exist throughout Sweden were taken into account when writing Wintersoldier.

The more skilful you become as a winter soldier the more the winter conditions become your ally.

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WINTERSOLDIER

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Manual for Basic Training in Winter Conditions

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Wintersoldier riktar sig främst till utländsk militär personal och svenska instruktörer som deltar i Försvarsmaktens övnings- och utbildningsverksamhet som bedrivs inom ramen för grundläggande vinter-, fjäll- och överlevnadstjänst, under vinterförhållanden.

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Foreword

The 1997 edition of *Wintersoldier* complements *SoldF* (Soldier´s Field Manual) and *SoldR Mtrl* (Soldier´s Equipment Instructions) providing advice and recommendations for your performance both on and off the winter battlefield. *Wintersoldier* gives advice to all soldiers involved in national defence.

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The wide ranges of winter conditions that exist throughout Sweden were taken into account when writing *Wintersoldier.*

The more skilful you become as a winter soldier the more the winter conditions become your ally.

Wintersoldier has been translated into English to facilitate international cooperation on basic combat training in winter conditions.

The avalanche hazard scale with additional explanations and avalanche bulletins provided in the appendix are taken from the *Military Handbook for Abseiling and Climbing*.

Johan Skullman

WINTER ENVIRONMENT

History 9
Knowledge, Skills and Experience 11
How the Cold Affects You 12
Combat in Cold Environment – Basic Facts 15

COLD INJURIES

Local Cold Injuries 22
Hypothermia 24
Trench Foot 26
Chilblains 26
Preventative Measures 27

CLOTHING

Natural and Synthetic Fabrics 31
The Multiple Layer Principle 31
Keeping Dry 32
Headwear 34
Handwear 35
Footwear 36
Snow Camouflage 36
Body Armour and Helmet 37
Supplementary Garments 37

EQUIPMENT

Weapons 40
Communications Equipment 42
Optical and Opto-electronic Equipment 44
Motorised Vehicles 44
Skis and Snowshoes 48
Sleds 50
Cooking Equipment 51
Load-Carrying Equipment 52
Sleeping Bags 53

PROTECTION AGAINST NBC AND INCENDIARY WEAPONS

Equipment 56
Detection 57
Decontamination 57

TROOP MOVEMENTS

Planning 60
Dismounted Marches 63
Mounted Marches 66
Considerations Before a March 68
Considerations During a March 68
Considerations During Breaks 68
Helicopter Transport 70

FIELD WORK

Camouflage 74
Faked Tracks 74
Fortifications 75
Crossing Frozen Waterways 76
Field Work 79
Blasting 80
Mining 80
Mine Detection and Clearing 81

REST AND RECOVERY

Avoiding Detection 84
Protection Against the Effect of Fire 85
Bivouacking 86
Guard Duty 90
Bivouacking in Combat 91

COMBAT

Preparations 94
Movement Techniques 96
Firing Readiness 99
Firing Points and Firing Positions 100
Mechanised Unit 102
Caring for the Injured 103
Breaks in Battle 104

MOUNTAINOUS TERRAIN

Equipment 108
Map Reading in the Mountains 110
Stormy Weather and Poor Visibility 111
Bivouacking 117
Injuries and Accidents in the Mountains 123
Avalanches 127
Appendix 1: Avalanche Hazard Scale 136

WINTER ENVIRONMENT

History 9
Knowledge, Skills and Experience 11
How the Cold Affects You 12
Combat in Cold Environment – Basic Facts 15

Winter in Sweden lasts from mid-November until the end of April, but varies from year to year. Traditionally, the northern part of Sweden is regarded as the true winter region. However, Sweden is 1570 km long and therefore there are great variations. It ranges from wet snow conditions accompanied by a wide range of temperatures in the southern and central regions of Sweden to dry, windswept conditions with fairly constant low temperatures in the north. All these conditions need to be taken into consideration for you to learn the different environmental characteristics.

Average Temperature in February
(over a 30 year period)

Average Snow Depth in February
(over a 30 year period)

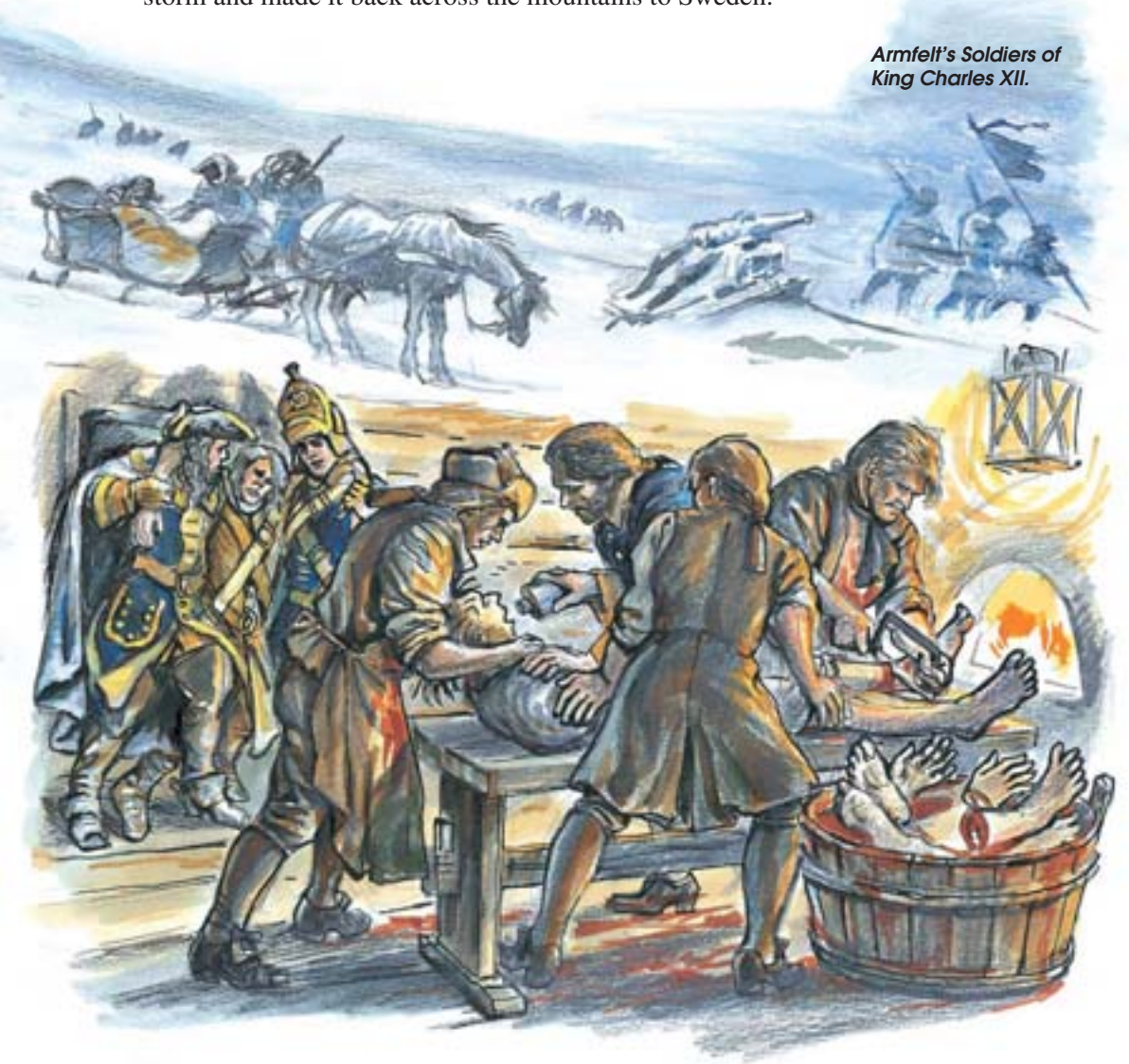
The many variations in the winter environment provides opportunities for you and your unit to gain experience and to practice in a variety of situations. A winter environment can mean many hardships for those who do not have the required knowledge and skills. To a certain extent, a person's ability to adapt to the cold can be influenced by a gradual acclimatisation to the environment.

History

Throughout history, there have been many examples of wars being fought in difficult winter conditions. The following examples occurred in places probably not associated with winter, snow or below freezing point.

In 218 BCE, Hannibal lost almost half of his 46,000 men crossing the Pyrenees and the Alps on his way to the Po Valley.

In August 1718, Carl Gustav Armfelt marched 10,500 Soldiers of King Charles XII from Duved, Sweden, to Trondheim, Norway, in order to capture the city. Armfelt failed and during his retreat at the start of 1719, his badly battered army of 5,150 men encountered a snowstorm. Only 1,700 men survived the storm and made it back across the mountains to Sweden.



Armfelt's Soldiers of King Charles XII.

During WW I 115,000 British and French soldiers suffered from cold injuries. Many were affected by trench foot, which is caused by prolonged exposure to dampness. During WW II, approximately 200,000 soldiers were disabled by cold injuries.

Other examples of 'winter warfare' are the Yom Kippur War fought in 1973 in the Golan Heights and the Falklands War in 1982 in which many British soldiers suffered from cold injuries.

During the Gulf War in 1991 many of the Special Forces were surprised by sudden storms of wet snow in the mountains near the Syrian border. Even several of our international forces, for example those in Bosnia, have served in difficult winter conditions.

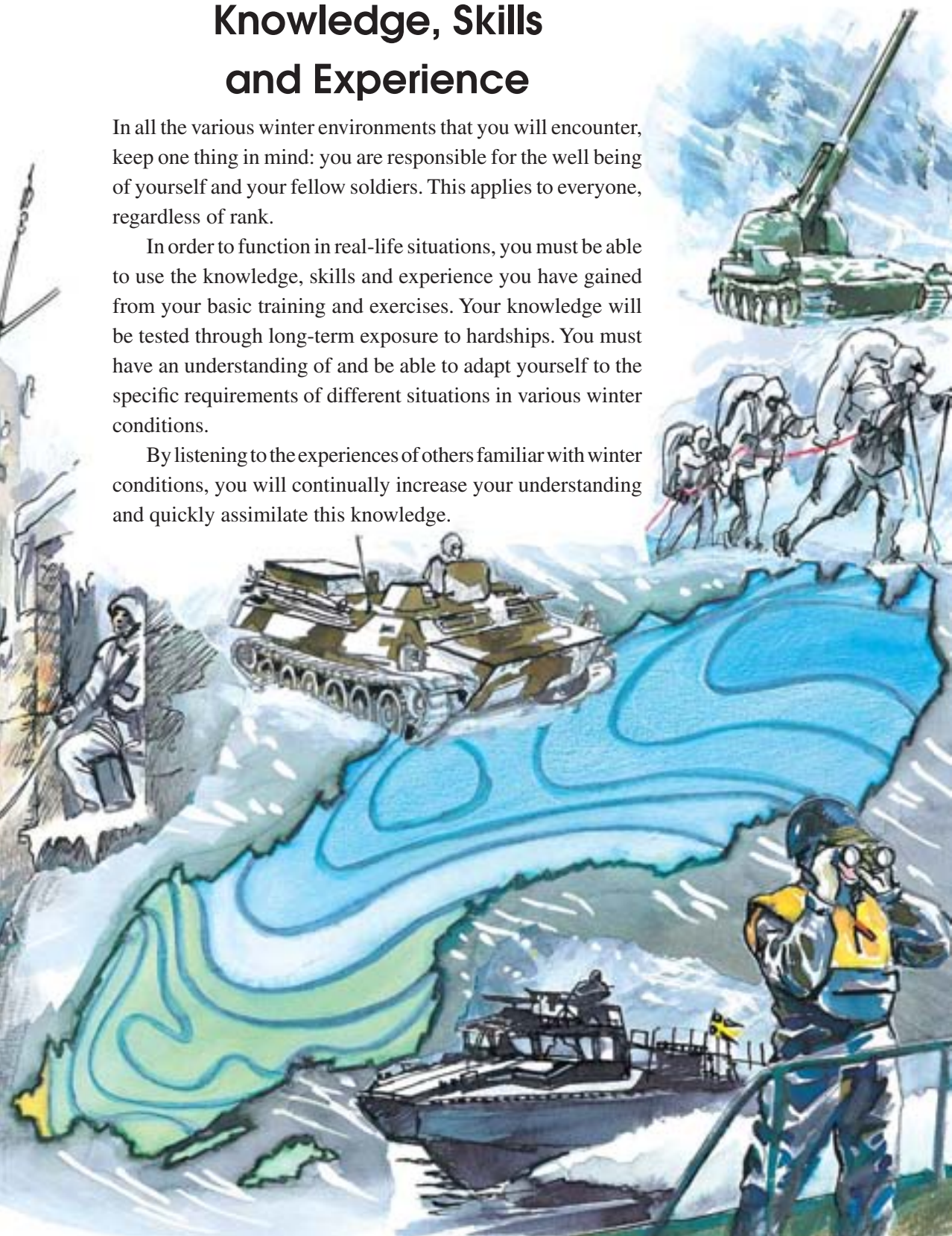
During crisis, conflict or war, you are likely to find yourself in similar situations and it is imperative to be well prepared.

Knowledge, Skills and Experience

In all the various winter environments that you will encounter, keep one thing in mind: you are responsible for the well being of yourself and your fellow soldiers. This applies to everyone, regardless of rank.

In order to function in real-life situations, you must be able to use the knowledge, skills and experience you have gained from your basic training and exercises. Your knowledge will be tested through long-term exposure to hardships. You must have an understanding of and be able to adapt yourself to the specific requirements of different situations in various winter conditions.

By listening to the experiences of others familiar with winter conditions, you will continually increase your understanding and quickly assimilate this knowledge.



How the Cold Affects You

As mammals, humans function best when the surrounding temperature is 27°C (at rest). At this temperature, the body neither sweats nor shivers, its temperature is balanced. The skin temperature is then between 33–34°C.

The body works to maintain a constant inner temperature of about 37°C so that the vital organs function optimally. Winter conditions require that you take the right measures in order to maintain this temperature. You must dress properly or keep moving in order to avoid freezing. You must also eat and drink.

How the Body Regulates its Temperature

The body's ways of maintaining a normal temperature in the vital organs – brain, spinal cord, heart, lungs, liver and kidneys – are *blood circulation, sweating and shivering*.

The body's core.

Blood Circulation

The body regulates its temperature by circulating blood between the core and the skin. If the core's temperature is too high, more blood is pumped to the skin in an attempt to cool down and get rid of excess heat. This process can be seen when skin becomes red when warm. The skin becomes white when a person is cold because less blood is pumped to it in an attempt to keep heat in the body. When this happens, the arms and legs receive less blood and the hands and feet lose flexibility. If the temperature in the hands falls to 15°C, the fingers become inflexible and cannot be used. It becomes impossible to open a rucksack, zip up a thermal jacket or put on skis.

A lot of heat is lost through the head because the body must maintain a constant temperature in the brain. The brain needs oxygen continuously in order to function. Therefore the body cannot reduce the flow of blood to the brain in an attempt to regulate its core temperature.

At -10°C 50% and at -20ºC 75% of the body heat lost is through the head of a person not wearing anything on his head.

Sweating

If the body temperature rises because of hard physical exercise or because of too many layers of clothing, the body will increase blood flow to the skin in an attempt to cool down. If this is insufficient, then you start to sweat. Your body will then attempt to rid its skin of sweat. This requires heat, which means that the body's temperature will fall.

Evaporation from the skin happens all the time, even in cold weather. Between 0.5–1 litre of water is lost through evaporation every day. Evaporation after sweating due to hard physical work can mean that up to 4 litres of water is lost per hour.

When there is a risk of sweating, certain clothing must be adjusted in order for the body to rid itself of excess heat.

"If a man sweats, he dies."
Greenlandic expression

When there is a risk of sweating, certain clothes must be adjusted.

Ventilate by...

- Opening your coat at the neck.
- Taking off mittens or gloves.
- Taking off cap or helmet for a short time.
- Unzipping your fly.

Shivering

Shivering is the involuntary contraction of muscles in order to increase body temperature. It starts slowly and culminates in a violent shaking of the whole body. Shivering is the body's protection against cooling down and it is a signal that you must do something – put on thermal clothing, begin vigorous physical exercise, go into a warm house or tent or eat and/or drink something warm.

CAUTION!

Risk of cold injury increases when it is windy. The risk also increases as the wind speed increases.

How the Body Looses Heat

The percentage of the body's heat loss varies according to external factors: how windy it is, what clothing you are wearing, whether you are standing or lying in the snow.

The Body Loses Heat Through:

Conduction
Heat loss from the body to colder, exterior spaces.

Radiation
Particularly from parts of the body that aren't protected by proper clothing.

Convection (wind)
Cold air comes in contact with the body and 'steals' heat (especially in very windy conditions and when a person is not wearing windproof clothing).

Evaporation
Through both exhaling and through the skin (sweat).

The longer the body is exposed to extreme cold, wind and dampness, the greater the risk of cold injury.

How the Wind Affects You

When there is no wind and you do not move around too much, the air next to your body warms up and remains there as a protective barrier. However, in windy conditions, the warm air around your body is blown away and replaced by cold air. Wind and wind speed increase the body's heat loss (convection). The table below shows the effects of wind and wind speed on unprotected skin at different temperatures.

WINDCHILL INDEX FOR DRY SKIN

Wind		Air Temperature °C								
M/m	km/h	0	-5	-10	-15	-20	-25	-30	-35	-40
2	7	-1	-6	-11	-16	-21	-27	-32	-37	-42
5	18	-9	-15	-21	-28	-34	-40	-47	-53	-59
8	30	-13	-20	-27	-34	-41	-48	-55	-62	-69
16	60	-18	-26	-34	-42	-49	-57	-65	-73	-80
25	90	-20	-28	-36	-44	-52	-60	-69	-77	-85
		Little risk for cold injury (5%)	Big risk (50%)	Very high risk of cold injuries – a few minutes to a few seconds (95%)						

How Moisture and Dampness Affect You

Cold injuries often occurs because of damp or wet clothing and can occur even in temperatures above 0°C.

Moist air always feels colder than dry air even if the temperature is the same. This is because the body gives off more warmth through conduction to water molecules than to air molecules. In Gothenburg in the South of Sweden, -10°C feels colder than -10°C in Arvidsjaur in the North, because the moisture in Gothenburg's sea air cools the body more easily than Arvidsjaur's dry air.

Combat in Cold Environment – Basic Facts

Physical Condition

Being in good physical condition is a must to maintain combat performance in the winter. Your physical training must focus on muscular endurance and stamina. Winter acclimatisation and a strong will are also important factors that affect combat performance.

Keep in mind that smoking and drinking alcohol considerably reduce your physical performance.

Make sure you are always dry, warm and fed.

Fluids

Normal daily fluid intake should be about 3 litres. This amount increases in winter because of the large amount of evaporation that occurs when you exhale. You also lose fluid when your body attempts to warm and moisturise the cold, dry air you inhale. Therefore, in the winter it is important to drink 4 to 5 litres of fluids a day.

The fluids you drink should also provide carbohydrates. Dextrose, for example, allows the body to better absorb the fluid itself. Try to always drink warm liquids (at least 20°C).

Whenever possible, water should always be taken from an open and flowing source. There will be times when you will have to melt snow. Make sure that this snow is not dirty or contaminated.

Snow is porous and contains a lot of air. When melting it, make sure that it is packed firmly into the container.

To avoid the liquid in your water bottle or thermos from freezing, pay attention to how you store them. In extreme cold, it might be necessary to carry the water bottle inside your camouflage jacket, near the body. For example, the water bottle can be carried on a strap around the neck.

CAUTION!

Drink at least 4 to 5 litres of fluid a day.

When your body cools down, it looses fluid by increasing urine output (cold diuresis). Blood circulation, concentrated in the body's core, sends a signal to the kidneys to dispose of excess fluids. This means that you need to urinate more often.

You can see for yourself if you are drinking enough by monitoring the colour of your urine. If the urine is dark, you need to consume more fluids. Clear, transparent urine means the body is receiving enough fluid.

WARNING!

Dark urine is a sign of dehydration.

Remember...

- Drink small amounts often!
- Drink at least 4 to 5 litres a day!
- Drink warm liquids!
- Avoid quenching thirst by eating snow!

Diet

In winter it is important to eat foods high in nutritional value that will provide a lot of energy, which is necessary for endurance. Winter increases your daily calorie needs to 15,000–30,000 kJ per day. When you are tired, it is tempting not to prepare or eat balanced meals. By doing so, you will not get the energy necessary to cope with the stresses and strains encountered in training. The nutritional composition of food should be 60% carbohydrates, 30% fat and 10% protein. To get this balance you must *always* eat all the food you are allotted. Increasing fat intake and decreasing carbohydrates will be beneficial for long-term duty in cold weather. Keeping a supply of energy bars, nuts, chocolate or raisins in your pocket will provide you with a source of extra energy when you need it.

CAUTION!

Eat all the food you are allotted!

Always heat your food because frozen food can give you diarrhoea and cramps. Eating and digesting frozen food uses a lot of energy and you risk losing necessary body heat.

Clothing and Equipment

In order to stay and work in a winter environment, it is important to understand the possibilities and limitations of the human body. Conditions for survival in winter are, of course, based on having the right clothing and equipment because humans are naturally suited to a more tropical climate. One example of the capacity to adjust to extreme temperatures is the Inuit's ability to live in areas with extreme cold and dampness.

The principles for what winter clothing to wear and how you should use the clothes are of great importance. Not only do the clothes protect against the cold and wet, they also handle overheating due to sweating. An understanding of the clothing and equipment will make it easier to improvise because alternative and temporary solutions will often prove to be crucial when standard equipment is broken or unavailable.

Experience has shown that 30% of a soldier's total capacity depends on clothes and other equipment. The other 70% depends on the ability to use his knowledge and experience, particularly in winter conditions.

Today many comparisons are made between the clothing and equipment used in the military service and in outdoor activities. However, military activity is unique and specific. Clothing and equipment used during training and combat must be durable and must also protect against, for example nuclear, biological and chemical (NBC) weapons and fire. These factors and the fact that the equipment will be used on a daily basis are reasons for not using civilian clothing.

Regardless of rank, maintenance of equipment and organisation of activities are of the utmost importance. Pay close attention to your work!

Stress

In various winter environments many factors can cause stress. Mistakes often result from inexperience and fear of performing a task incorrectly. Stress is often the cause when many small, yet important, routine measures are not carried out, for example, visiting the bathroom, eating and drinking enough and dressing appropriately for the weather. By learning from the knowledge and experience of others, from your own observations, from your winter training and from pushing yourself beyond your limits, you will discover new aspects of your personality. This is absolutely necessary in order for you and your unit to be able to handle the stress and hardship the group will experience. Learn from the mistakes of others because you cannot afford to make your own.

Hygiene

Personal hygiene has consequences on the unit's combat performance, and in the long term the consequences may be fatal, for example, infections, skin and intestinal illnesses. In winter it is often more difficult to maintain personal hygiene because of the cold and the limited availability of water. Take every opportunity to maintain personal hygiene, particularly when you have access to warm water and a warm space, for example, when you are fire watch.

Remember…

- Wash and shave before you rest to give the skin time to build up its own protection (3 to 4 hours)!
- Wash your hands after using the toilet!
- Wash your feet, socks and underwear as often as possible!
- Wash your genitals whenever you have the opportunity!
- Do not use skin lotion on your face in extreme cold. Moisture can cause frostnips.

Rest

Being well rested increases the possibilities of doing a good job. Soldiers need to be given every opportunity to rest. This especially applies to commanders, who often do not allow themselves enough rest.

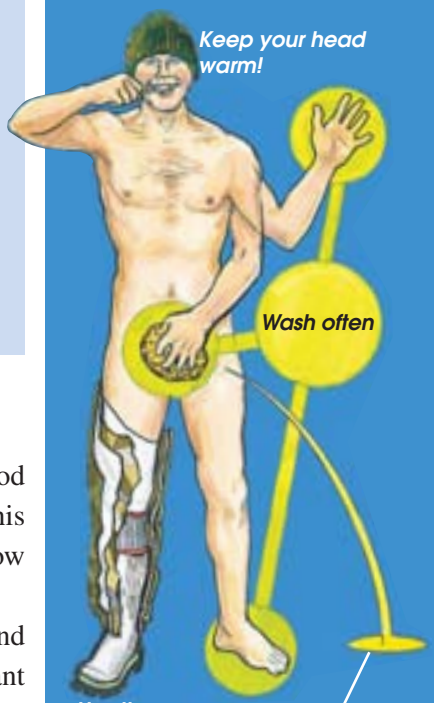
To recover your performance level after a physical and mental challenge, for example, winter combat, it is important to rest and sleep from 3 to 4 hours, when a break in the fighting allows, to one or more days recovery.

As a soldier, you need to take every opportunity available to rest, even for short periods of 15 to 20 minutes. The rest is better and the body recovers quicker if you have the opportunity to eat and drink beforehand.

Make sure you keep warm, dry, well fed and well rested.

Consume warm food and drink.

Do not drink alcohol or smoke cigarettes.



CAUTION!

Make sure to eat and drink before resting.

COLD INJURIES

Local Cold Injuries	22
Hypothermia	24
Trench Foot	26
Chilblains	26
Preventative Measures	27

Most cold injuries can be avoided if the right precautions are taken. The body's ability to maintain a constant temperature lowers the risk of cold injuries. If your equipment is used correctly, it will provide good protection even in extreme conditions.

A superficial cold injury that is treated immediately will leave little or no scarring once healed. Deep tissue cold injuries take a long time to heal and can result in lifelong damage. An area of the body that has had a previous cold injury, is very sensitive to the cold and can easily become affected again.

Local Cold Injuries

CAUTION!

Glasses, jewellery and watches containing metal can cause superficial cold injuries.

When one particular area of the body is effect by a cold injury, it is known as a local injury. A local cold injury can be either superficial or deep.

White spots appear on the sensitive skin of the cheeks, nose or fingers if they are exposed to cold or wind. These spots indicate *superficial cold injury*.

Serious injury occurs if the skin is exposed to cold and wind for long periods. With long-term exposure, the cold freezes the underlying tissue and this is known as *deep tissue cold injury*.

Superficial cold injury (frostnip)

Superficial Cold Injuries (Frostnip)

Symptoms

- Sharp pain changing to numbness. A person may not be aware of the onset of sharp pain in certain situations, for example, in very windy conditions or in stressful situations.
- Skin turns cold and white (white spot), but is not hard and can move freely and is not stuck to the tissue underneath.

Treatment

- Find protection against the cold and wind.
- Add thermal insulation.
- Have a warm, sweet drink.
- Stay active.
- Re-warm affected area using your own or a colleague's body heat. Skin to skin. DO NOT RUB!

  Face: Re-warm with warm hands.

  Hands: Place in armpits under your clothes.

  Feet: Place in colleague's armpits under the clothes.
- Re-warm until sensation, colour and movement return.
- Protect affected area from further cold injuries.

Deep Tissue Cold Injuries (Frostbite)

If treatment of a superficial cold injury does not have any affect within 20 to 30 minutes, then considered it a deep tissue cold injury.

Symptoms

- Skin is hard and numb, and seems to be attached to the tissues underneath.
- Skin is whitish-yellow or mottled. It will turn reddish-blue once treatment starts.
- Blisters appear within a few hours.

Treatment

Deep tissue cold injuries should be treated by a doctor. If it is not possible to seek medical attention within a reasonable amount of time (2 to 3 hours), follow these instructions:

- Never start treating the deep tissue cold injury unless you are certain that once started, treatment can continue and that you can protect the affected area from refreezing during transport to the doctor's.
- Immerse the affected area, or if possible, the entire body, in warm water (40–42°C) for at least 30 minutes or until feeling and movement is restored. *Continually refill basin or tub with warm water because it will cool down quickly*.
- Painkillers should be given because treatment is very painful.
- Do not allow patient to stand on an injured foot before or after treatment.
- Warning! Socks might have frozen to the skin on the feet. Treat the feet with the socks on.
- After this treatment, the patient must receive proper medical attention.

Deep tissue cold injury immediately after thawing.

Deep tissue cold injury after thawing.

Deep tissue cold injury after about 2 weeks.

Healed deep tissue cold injury.

CAUTION!

Always contact a doctor in cases involving deep tissue cold injuries!

Hypothermia

If the body continually loses more heat than it can generate, then a person becomes hypothermic. Hypothermia can occur when you get wet and are exposed to stormy weather with strong winds or if you are injured and must sit or lie still for a long time. *Water and wind* combined with the *lack of body movement* cause significant heat loss and hypothermia. Hypothermia can occur even when the temperature is above 0°C.

Being affected by hypothermia in intensely cold temperatures can also lead to superficial and deep tissue cold injuries.

If you fall into cold water, you will cool down very quickly because water conducts off heat 25 to 30 times more quickly than air.

Reactions of the Body to Decreasing Temperatures	
	Mild Hypothermia
35°C	Severe shivering, loss of motor skills, impaired judgement, apathy
33°C	Decreased shivering, loss of movement in hands, disorientation
	Severe Hypothermia, Unconsciousness
30°C	No Shivering, unable to walk, severe disorientation
28–30°C	Weak pulse and breath, risk of heart palpitations (irregular rhythm)
25–27°C	Unconscious, can appear to be dead

Treatment of *Mild* Hypothermia

- Get out of the wind.
- Change into dry clothes, or add thermal insulation.
- Have a warm, sweet drink if you can hold the mug.
- If you are 'just cold', keep moving, be active.
- Enter a warm environment (truck, tent, building) as soon as possible.

CAUTION!

The first signs of hypothermia are sluggishness and apathy!

Treatment of *Severe Hypothermia* or *Unconsciousness*

- Handle patient carefully. Avoid unnecessary movement!
- Examine patient in a sheltered place. Brush away any accumulated snow. Carefully remove any wet, *outer* clothing and wrap the person in a cold weather coat, emergency blanket or regular blanket. Wrap the arms, legs and body separately. Do not forget to wrap the head!
- Protect patient from the cold ground.
- Lie patient in a semi-prone position.
- Do not start to re-warm patient. Insulate only!
- Carefully carry patient, in prone position, to nearest first-aid centre or doctor's.
- Check patient's breathing often.

WARNING!

A seemingly lifeless and hypothermic person, who is found outside, should always be treated as alive. Only a doctor can make a diagnosis!

Trench Foot

Trench Foot

Trench foot is caused by prolonged (days or weeks) sitting or standing still in cold and damp conditions or by having constantly damp feet. Damage can occur even when the temperature is 17°C or 18°C. Trench foot is also known as immersion foot or paddy foot.

Symptoms

- Numbness, stabbing pain, swelling and wrinkled, waxy, white skin.
- When re-warmed, feet become red or bluish-purple.

Treatment

Trench foot must be treated by a doctor and requires long-term convalescence.

Preventative Measures

- Keep feet dry and well protected against the cold ground.
- Change socks often.
- Remove shoes as often as possible. Air feet and shoes.
- Massage feet for at least 5 minutes a day.
- Elevate feet while resting.

CAUTION!

Do not stand on your feet if they are painful or discoloured!

Chilblains

Long-term exposure to the cold can dry the skin and lead to chilblains appearing on lips, fingertips and cuticles.

Make a habit of applying moisturiser to lips and fingers at the start of rest periods.

Preventative Measures

The commander of each unit must carefully plan troop exercises and then check the following list.

Before Troop Exercises

- Check that regular rest periods and water and meal breaks have been scheduled.
- Check temperature, wind and weather reports.
- Check that soldiers have clean socks and dry footwear with insoles.
- Check that soldiers' clothing is appropriate.
- Check that soldiers have had enough food, water and rest.
- Check that equipment is complete, appropriate and that it functions well.

During Troop Exercises

- Alternate between skiing and skijoring to keep warm. Change tempo depending on the weather.
- Adapt clothes to circumstances (give orders to change clothes as the weather requires).
- Check soldiers' well-being (regularly).
- Have soldiers check each other's faces for signs of cold injuries.
- Check soldiers hands and feet.
- Feed soldiers regularly and make sure they drink warm liquids.

After Troop Exercises

- Inspect soldiers (if at all possible, soldiers should be barefoot).

Personal Safety Checks

- Have you had water and food regularly?
- Are you wearing clothes appropriate for the exercise? Are you too warm? Are you sweating? Are you cold? Make the necessary changes!
- Are your clothes and boots dry?
- Do you have feeling in your face and hands?
- Do you have feeling in your feet? In your toes? Remove your boots if unsure.

You can avoid cold injuries if you pay close attention to food, drink and clothing. Pay close attention to the preventative measures. A rule of thumb is to always be DRY, WARM AND FED.

Military clothing is the first line of defence in your battle against the cold, wind and damp of winter. However, no matter how good the clothes are, you are still the most significant factor. Your ability to apply your knowledge and skills to make use and take care of the equipment is very important. This is vital to your survival in cold, windy and damp conditions.

Winter conditions place high demands on your ability to adapt your clothing to different situations. You must know your capabilities and limitations and the functions of your clothing in different climates and environments.

CLOTHING

Natural and Synthetic Fabrics	31
The Multiple Layer Principle	31
Keeping Dry	32
Headwear	34
Handwear	35
Footwear	36
Snow Camouflage	36
Body Armour and Helmet	37
Supplementary Garments	37

The Multiple Layer Principle

Natural and Synthetic Fabrics

Military clothing is made from both natural and man-made materials. These fabrics have both advantages and disadvantages depending on the environment in which they are used.

Regardless of which fabric is chosen for an article of clothing or any other part of your equipment, it has all been thoroughly tested to check, for example that it is washable, durable, flameretardent and fireproof and hypoallergenic. It has also been safety checked against elektrostatic conductivity. The material provides insulation whether it is dry or wet. Tests are carried out in laboratory conditions and in the field where overall functionality can be tested.

You can be sure that your clothing will serve its purpose well if used properly.

The Multiple Layer Principle

Cold weather uniforms are based on the multiple layer principle. The inner layer draws perspiration away from the skin while the *intermediate layer* insulates by trapping body heat. The *outer layer* protects against wind and dampness. Wearing *supplementary garments* will increase protection against the elements.

The clothes are designed so that circulation and ventilation are not restricted. This also applies to hand and footwear. Air insulates because it is a bad conductor thus trapping warm air. When your clothes, hand and footwear are too tight, the amount of space for insulating air is drastically reduced. However, be sure not to wear clothes that are too big or else it will be difficult to warm the air between the layers.

Your clothes are a part of a flexible system that offers many possibilities to ventilate excess heat and to insulate against the cold.

Different Clothing for Different Activities.

Stationary work.

Hard work for long periods of time.

Hard work for short periods of time on repeated occasions.

Keeping Dry

You will certainly be in situations where the temperature will change from cold to warm, for example, getting in and out of vehicles, moving quickly for a while followed by waiting in a trench or going in and out of tents or buildings. You run the risk of becoming damp or downright wet, from the inside out and from the outside in. Damp clothes are less able to protect against the cold.

It is important to keep your clothes free of snow, particularly when entering a warm environment. Allowing snow to melt on your clothes will make them damp. When you go outside again, the clothes will freeze and you will cool down quickly and consequently your combat performance will suffer. Since you cannot avoid becoming damp and wet, it is important that you learn several ways to dry your clothes.

During a rest period or a break in combat, it is important to take the opportunity to ventilate and adjust clothing to prevent excessive overheating.

Keeping Dry

- Adjust clothing to suit the temperature and, above all, the type of exercise you are involved in.
- Use less clothing if you expect to become damp or wet.
- Save the supplementary garments for rest periods and breaks.
- Brush off snow from clothes and especially from boots before entering a warm area.
- Lower the temperature in the vehicle.

What To Do When Your Clothes Are Wet

- Change into dry clothes when you are certain that you have the opportunity to dry your wet clothes.
- Dry wet clothes *in a warm environment*, for example, a tent, house or vehicle. Take every opportunity to do this.
- Damp clothes can be dried with the help of your *body heat*. Do this while performing lighter duties.
- Dry socks, handwear, insoles and caps inside the combat trousers, along your thighs or inside the sleeves of your combat jacket.
- Dry clothes using *freeze-drying*. Allow the moisture in the clothes to freeze and then shake off the ice.

Always check with your commander first before wearing your own outdoor clothing while on duty, because they might not offer the same protection as military clothing against, for example fire or chemicals.

Wash your clothes whenever the opportunity presents itself. Dirty clothes, like wet ones, lose much of their performance.

Headwear

The head loses the most heat. The three types of caps included in your clothing system help control heat loss.

Make sure your caps are easily accessible, for example, in the pockets of your field or snow jacket. This allows you to regulate your body temperature by quickly changing caps.

Field caps with earflaps are best suited for use during troop movements when a lot of excess heat will be generated. In windy conditions, unfold the earflaps and the forehead protector.

Fur caps and *balaclava* offer extra warmth and should be used in extreme cold weather. Generally, they are used while resting, sleeping or on guard duty.

You will wear a *helmet* often. Add warmth under your helmet by putting on your balaclava or field cap.

The fur cap cannot be worn under the helmet. It will cause the helmet to sit unsteadily on the head. This also reduces the helmet's protection of the sides of the head. The helmet cover is two-sided: the green camouflage print for non-snowy conditions and the white side for camouflage in snowy conditions.

Four ways to wear a balaclava.

Three ways to wear a Fur cap with earflaps.

Change caps to suit the type of activity.

Handwear

Hands are the most important tools for tasks requiring fine motor skills. The inability to use your hands will cause serious problems, particularly in wintertime. Your clothing system includes different types of protective handwear: *mittens with cuffs and inner linings* and *five-fingered gloves with inner linings*. Mittens must be big enough for you to wiggle your fingers without difficulty while wearing the five-fingered gloves.

Mittens with cuffs and inner lining

Remember...

- *Always clip the mittens to the jacket's sleeves*. Failure to do so could result in the mittens getting lost in the snow when, for example, you take them off to use your weapon while engaging the enemy. A mitten can blow away in strong wind if it is not clipped to a jacket.
- *Do not touch metal* or similar materials with bare hands in cold conditions. You risk freezing your hands to the metal or getting a local cold injury. Wear gloves or mittens.
- Keep an *extra pair of mitten liners* with you if possible.
- Increase warmth during training by pulling down the *cuffs of your thermal undershirt* over your hands.
- Use an outer or a knee sock as *a substitute for a lost glove*.
- *Never breathe warm air into gloves*. Exhaled air contains a lot of moisture that will become trapped in the gloves and lessen their protectiveness.
- Do not wear just inner linings or five-fingered gloves while working. Protect gloves from damp and damage by using them only with the mittens.

Five-fingered gloves

Five-fingered glove liners

CAUTION!

Protect your gloves against damp and damage.

Rubber boots

Thermal socks

Winter boots

CAUTION!

Do not expose footwear to extreme heat.

Footwear

Your clothing system contains two types of winter footwear.

Rubber boots with thermal socks are used in temperatures down to -10°C and if there is risk of wet snow or puddles.

Winter boots are used in colder, dryer conditions.

It is important to be able to wiggle your toes in your boots. Measure your feet while wearing both knee socks and outer socks in order to find the correct size for the rubber boots and the winter boots.

Insoles play an important role in trapping heat. Therefore, the insoles must be dried out regularly and changed when worn out.

Remember...

- Dry socks and insoles daily. Keep them clean and in good condition.
- Dry out rubber boots and winter boots at every opportunity. Do not expose to heat over 35°C. Extreme heat can warp the soles, shrink the leather and crack the rubber.
- Stuff newspaper into rubber boots and winter boots to absorb moisture.
- Remove winter boots as soon as possible in order to air out both them and your feet. This is particularly important when you are inside.
- Do *not* apply boot polish to winter boots in extremely cold conditions. The polish will freeze and the boots will become rigid.

Snow Camouflage

The snow camouflage protects against wind, snow and moisture. Use the jacket and trousers only when necessary; if the jacket and trousers are used as overalls, they will become dirty and lose their camouflage properties.

To maintain high combat readiness, wear your combat vest on top of your jacket. In certain situations when it is necessary to 'see and not be seen', for example, on lookout or reconnaissance, it is useful to wear your combat vest under your snow camouflage. Move at least two of your magazine clips into your breast pocket or front pockets in order to maintain firing readiness.

Body Armour and Helmet

Wearing body armour and a helmet will make you warm when you exert yourself, even if it is cold. You should be careful to get rid of extra heat by ventilating. If you sweat and cool down your combat performance will decrease.

Clean out moisture and dirt that accumulate in the pockets of your body armour and in the helmet to prevent icing.

Be sure to increase your fluid intake when you are wearing body armour and a helmet.

Supplementary Garments

Your supplementary garments help provide effective rest during breaks and when you sleep. They trap the body warmth that has built up when you were working. They shall provide protection in extreme weather conditions, for example, when you are exposed to strong winds, for example when you are skijoring or on air observer duty.

Apart from the balaclava and fur cap, you have a sweater and a thermal jacket in your clothing system. Certain units are also provided with thermal trousers.

Remember...

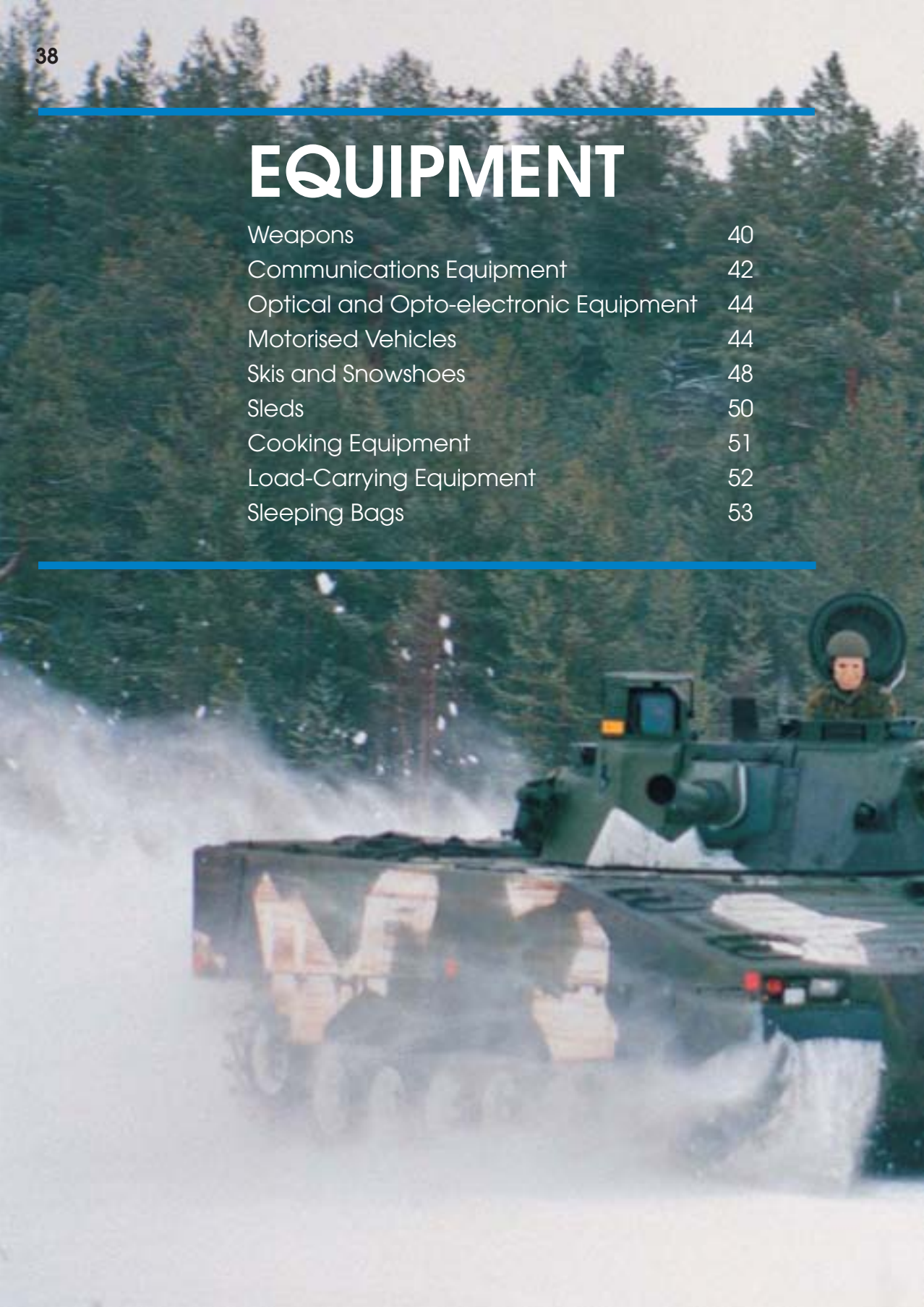
- Use your supplementary garments mainly when sitting or standing still, for example, during a rest period or on sentry duty.
- Never use a thermal jacket or thermal trousers when working, not even for light duties.

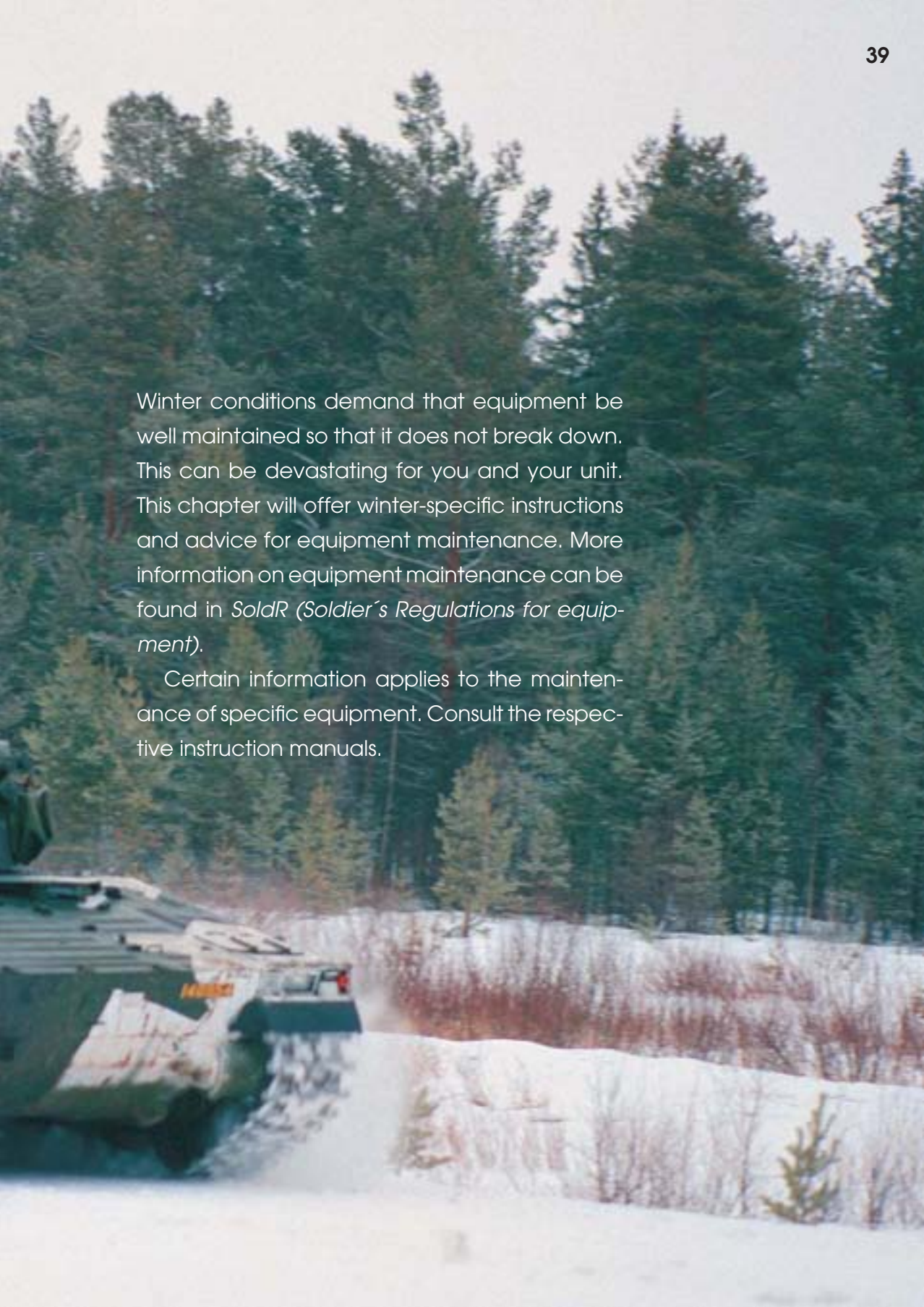
CAUTION!

It is as important to avoid sweating as to protect yourself against the cold!

EQUIPMENT

Weapons	40
Communications Equipment	42
Optical and Opto-electronic Equipment	44
Motorised Vehicles	44
Skis and Snowshoes	48
Sleds	50
Cooking Equipment	51
Load-Carrying Equipment	52
Sleeping Bags	53





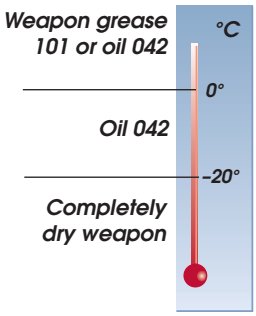
Winter conditions demand that equipment be well maintained so that it does not break down. This can be devastating for you and your unit. This chapter will offer winter-specific instructions and advice for equipment maintenance. More information on equipment maintenance can be found in *SoldR (Soldier´s Regulations for equipment)*.

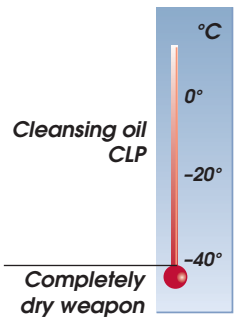
Certain information applies to the maintenance of specific equipment. Consult the respective instruction manuals.

Special weapons, such as the Sniper rifle PSG/90, may require winter camouflage.

Weapons

Oil used at different temperatures.





Protect your weapons and check their working condition regularly. Even ammunition and magazines must be checked. Avoid using weapon grease in winter. Instead, the weapon and its accessories should be oiled using grease 042 or cleaning oil CLP. The colder it is, the less oil the weapon needs. Grease and oil solidifies in cold temperatures and if there is too much of either on the weapon, it will not function smoothly causing firing malfunctions and stoppages.

When it is colder than -20°C, only use cleaning oil CLP. CLP maintains its viscosity down to -40°C. If CLP is unavailable, the weapon and the magazine must be completely dried.

When the weapon has become warm from firing, lightly oil the sliding surfaces of the loading chamber with oil 042 or CLP. The grease is kept in a pocket of the accessory box. The oilcan for machine gun 58 is found in bag 2. This oilcan should be filled with oil and carried by the machine-gunner.

Do not mix *mineral oils* (weapon grease 101 and oil 042) with *synthetic oil* (cleaning oil CLP). CLP loses its lubricating qualities at low temperatures.

Use a *muzzle cover* to stop snow from clogging the pipe. Muzzle covers should be used to protect breechblocks and muzzles of anti-tank weapons with rear gas vents (for example, in Carl Gustaf M3). Keep snow and ice away from chambers, mechanisms, sighting devices and magazines.

Weapons are sensitive to extreme temperature changes. A cold weapon begins to 'sweat' when taken into warm areas because the moisture in the warm air condenses against its cold surface. If the gun is taken into the cold again before the condensation has dried, ice will form on the weapon. When sleeping in tents, keep your weapon as cool as possible by storing it against the tent wall.

To avoid corrosion after the weapon and its accessories have been in the cold, wipe them off thoroughly and then store them at room temperature to dry. When the condensation has completely gone, wipe them once more and then lubricate with a thin layer of oil 042 or CLP. This daily care is especially important when the weapon is exposed to extreme temperature changes. A careless final drying will leave condensation under the layer of oil and this will cause corrosion. Condensation turns to ice when the weapon is taken outside again causing malfunctions the next time it is fired. In an emergency, putting 'Alcohol 35' in a completely frozen weapon can thaw it out completely.

WARNING!

Ice and snow in the bore or pipe can cause the weapon to explode.

Snow and Ice in or on Weapon Parts

- Pipe or barrel – can cause explosions
- Cartridge chamber – hampers loading
- Loading chamber – stops mechanism from moving
- Magazine – hampers loading
- Ammunition – hampers loading
- Sighting device – impossible to sight

Your weapon will not function properly!

Remember...

- Use grease sparingly.
- Use a muzzle cover.
- Do not expose weapon to extreme temperature variations.
- Frequently brush snow off weapon and regularly check its working condition.

Communications Equipment

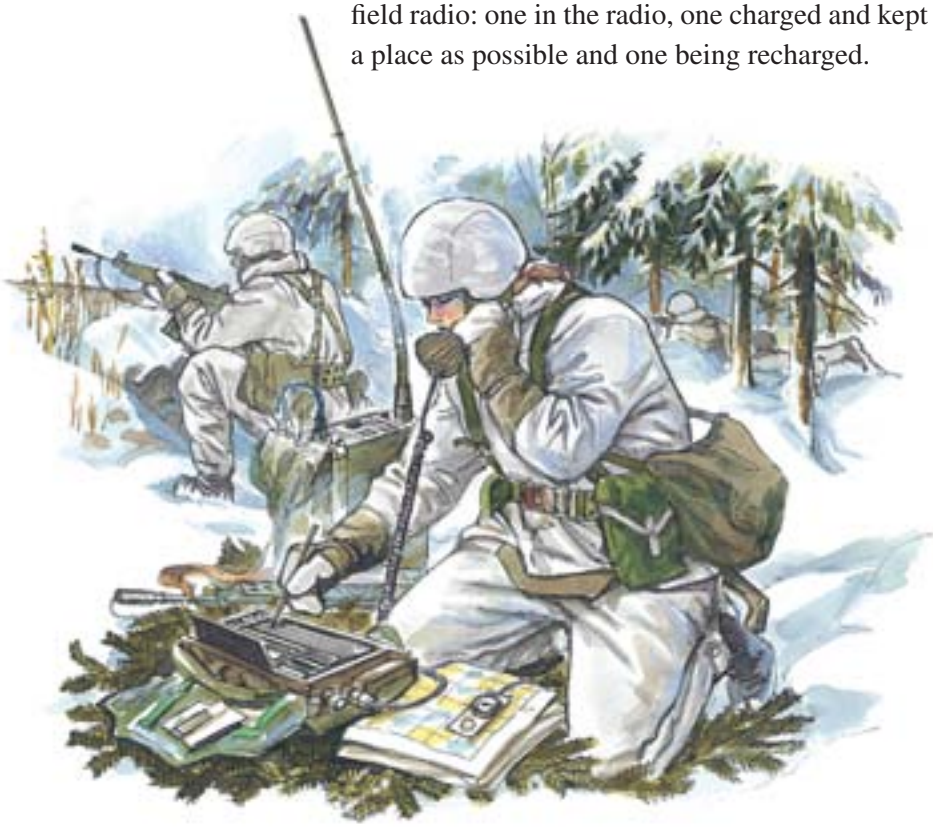
Maintain and check communication equipment in the same way and with the same regularity as you would a weapon. Intense winter cold decreases the range and security of equipment. This is caused by snow, ice and deep ground frost reducing the extension of radio waves and by the considerably reduced charge of the batteries in cold weather.

Charging Batteries

Re-chargeable batteries produce only 60% of their total capacity in temperatures below -20°C; dry batteries produce only 10%.

It is very important to have fully charged batteries and to keep the field radio and battery boxes warm for as long as possible, for example, in a truck or tent. Insulate the equipment when it is to be used outside.

Normally, there are three sets of battery boxes for each field radio: one in the radio, one charged and kept in as warm a place as possible and one being recharged.



For best results, recharge batteries in temperatures above freezing. Frozen batteries take several hours to thaw before recharging can begin.

When recharging batteries with a battery-charger connected to a vehicle's electrical outlet, for example, battery charger 246, make sure that the vehicle's battery is in good condition and that the engine is running during most of the recharging time. Otherwise, there is risk that the vehicle will not start after the batteries have been recharged.

Battery charger 246 requires 1.2 A/h from a 12 V vehicle battery (0.6 A at 24 V). It takes 12–14 hours to recharge a battery.

Remember...

- Never place a portable field radio directly on the snow. Always use a protective layer: spruce branches, straw or newspaper. Caution! Do not use material that will reduce the radio's range.
- Keep the batteries warm by carrying them next to your body or storing them in a heated space.
- Never warm batteries over open fires, heaters or other sources of heat.
- Protect plugs and keyboard (DART) from extreme temperature variations, ice, snow and moisture in order to avoid ice build-up. Use plastic bags as protective covers.
- Avoid ice build-up in the microphone's membrane by not speaking directly into the microphone or covering it with a sock.

Do not breathe directly onto the lenses of sights or binoculars, etc. Condensation on a lens can have fatal consequences.

Optical and Opto-Electronic Equipment

Optics is sensitive to condensation and ice build-up. Use anti-condensation agents and avoid extreme temperature variations. Certain optical and opto-electronic equipment, for example, image intensifier1010, has battery adapters to keep the battery warm. Use the battery adapter in temperatures below -10°C.

Motorised Vehicles

Starting the Vehicle

As a rule, military vehicles start and run at temperature above -15°C without problems, provided that a vehicle's battery is charged. The vehicle must be started and the engine sufficiently warmed up before departure. When starting a cold vehicle, it is important that the clutch is kept down and that the headlights and other electrical equipment are turned off so all the power from the batteries goes directly to the start motor.

CAUTION!

Read the section on cold starts in the vehicle's instruction manual.

Parking

Engine Heater

At temperatures between -15°C and -30°C it is a good idea to plug in the engine heater as soon as you park the vehicle. The engine heater's blowtorch should also be prepared.

The blowlamp, and if possible even the vehicle's battery, should be stored in a warm environment, for example, in the barracks.

Camouflage paper can be used as wind shields and insulation.

Insulation

In winter, always use covers, blankets or camouflage paper to keep the motor warm as long as possible when the vehicle is parked. This stops snow from getting into the motor and the air intake grille.

Motorcycles and *snowmobiles* do not have engine heaters. In very low temperatures they may instead be covered by snow. First, cover with camouflage paper and then with snow. Just before starting, the plugs should be warmed on a camping stove, for example, to facilitate starting.

Exhaust from a running vehicle can be used to warm up a motorcycle or snowmobile.

Combat vehicles, tanks and other heavy *diesel-driven vehicles* retain engine heat when parked for considerably longer than other vehicles because of big, heavy engines. Instead of engine warmers, most military vehicles have cold start devices and specially heated or insulated battery compartments.

In extremely cold temperatures or when there is no engine heater, vehicles should be started and warmed up at 2–4 hour intervals. Warm up at a higher RPM until the engine temperature begins to rise.

At all times while the vehicle is idling, make certain that its exhaust fumes do not enter trenches or tents.

WARNING!

Do not inhale exhaust fumes.

'Icebound' Vehicles

Keep belt assemblies and steering devices free of snow and ice to avoid freezing. This is especially important in the spring when temperatures are often above freezing during the day (thawing) and below freezing at night.

Park the vehicle on a bed of branches if there is a risk of wheels or tracks freezing to the ground. Pack the snow down first by driving back and forth across it several times. This will also allow easy access to the vehicle for maintenance and unloading without having to walk in deep snow.

Checklist

- Switch on engine heater a couple of hours before the start of the march. Remove radiator cap or the cap of the expansion tank in order to allow circulation in the cooling system.
- Connect the batteries after a 20–30 minute warm up period.
- Start the vehicle and let it idle.

CAUTION!

When using a blowtorch to heat the engine, the vehicle must be closely monitored.

In extreme cold it is important to drive the vehicle carefully for the first 10–15 minutes or for the first few kilometres. This is to allow the grease and oil in the power transmission, steering devices and track assembly to warm up before the engine is used at its maximum capacity.

When working with the vehicle, it is important to have a source of heat to keep hands and tools warm.

Fuel

Fuel is perishable. In times of crisis the only fuel available might have been stored for a long time or be of lower quality. This means that the ignition temperature will be considerably higher than usual and may make starting the vehicle difficult if measures to keep it warm have not been taken.

Ice Plugs

Breakdowns due to ice plugs in the fuel system and the carburator are not unusual. They often appear in cold temperatures or when there is a drastic change in temperature. Ice plugs develop because of condensation in petrol tanks and cans. Full tanks and cans reduce the risk of condensation build-up.

Ice plugs can be dissolved or prevented by adding alcohol. To prevent ice plugs in petrol tanks, add 1% alcohol (1 litre/100 litre or 2 dl/20 litre can). Add the alcohol after fuelling the vehicle.

To dissolve an ice plug, add 0.5–1 litre of alcohol. For diesel vehicles, 0.5% alcohol is enough. For best results, add the alcohol before the vehicle has been fuelled.

CAUTION!

To reduce the risk of condensation build up, keep petrol tanks and cans full.

Paraffin Crystals

Normal diesel fuel can 'gel' at -25°C because of waxy paraffin crystals. By adding kerosene, max. 40%, the temperature for the gelling process to start can be lowered to -35°C. Note that kerosene does not un-gel diesel fuel. Only heat will do that.

With light diesel or winter diesel (DBO 25) there is little risk of waxy paraffin crystals.

Important!

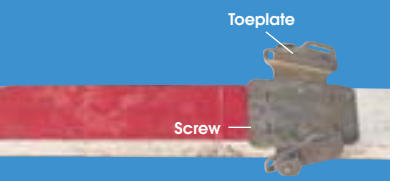
Petrol and petrol fumes can ignite at temperatures down to -20°C. Watch out for embers and sparks!

Drivers and refuelling personnel must always be extra careful when handling fuel and other liquids that do not freeze at temperatures below zero. Splashing liquids on yourself can result in cold injuries.

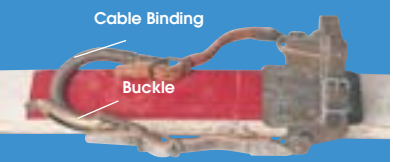
Drivers should use gloves and attach a nozzle to the "jerry" can. Refuelling personnel should only wear issued protective clothing.

WARNING!

Adjusting Skis

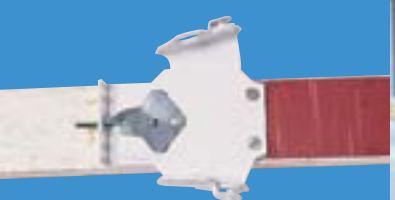


1. *Toeplates are adjusted to the shape of the sole. To loosen the screw, use the buckle.*



2. *This picture shows how the cable binding is mounted. Note that the inside buckle needs to be turned inwards, otherwise it will catch on the other boot.*

3. *Adjust the toe strap so that the shoe is kept in place by the toeplate. Winter boot 90 requires a longer toe strap because the boot is larger. Make sure the tip of the boot does not extend beyond the toe plate, in order to make kneeling possible.*



New Toeplates

Skis and Snowshoes

The Swedish Armed Forces use glued birch wood skis with a cable binding, a sprung cable that passes around the back of the boot. There are different kinds of bindings all with the same type of sprung cable. The poles are made of steel.

Snowshoes are used in mechanised infantry. Snowshoes are useful for moving short distances in deep snow.

Tarring and waxing

Wooden skis need to be sealed with tar. The tar prevents moisture from being absorbed by the wood and protects against wear. Tarred skis function well on most types of snow. For use on wet snow, the glide may be improved by applying candle or paraffin wax.

Tarring Procedure

- Create a handle by threading a steel wire through the hole in the ski's tip.
- Remove all dirt and old wax from the underside. The ski must be dry.
- Warm the ski with a blowtorch or over an open fire. In order to prevent it warping, start heating from the middle of the ski.
- Brush on a thin layer of tar and warm it to cause the tar to penetrate into the pores of the wood. The surface must not be burnt – when the tar bubbles, it is warm enough.
- Smooth out the unabsorbed tar with a brush and re-warm the area. Continue until the surface is saturated.
- Wipe off the excess tar while the ski is warm.

Inadequate tarring allows the skis to absorb moisture in mild temperatures. When it becomes colder, the skis freeze making it hard to ski.

For long-term storage, skis must be stored in a ski rack so that they do not become warped or loose their camber.

Sleds

The Swedish Armed Forces use many types of sleds. Just like wooden skis, wooden sleds require tarring and paraffin wax may be used to improve gliding. Modern plastic sleds do not require waxing.

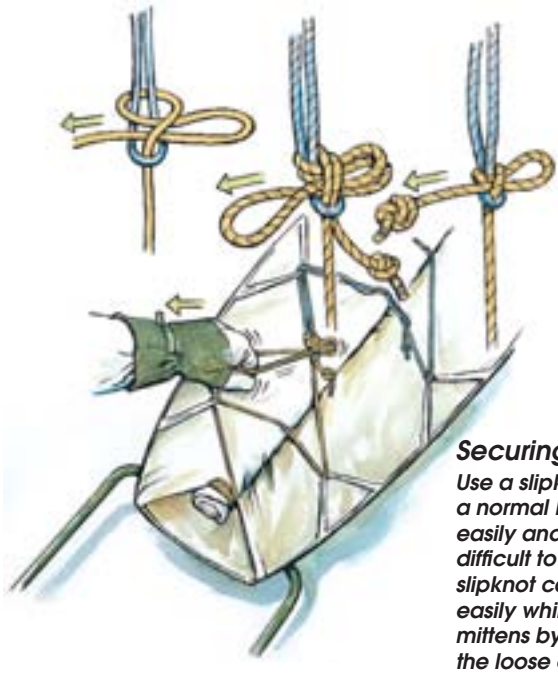
A sled must not be top heavy. The load must be well distributed and somewhat tail-heavy. A reasonable load for a sled pulled by two people is approx. 70 kg. In order to avoid tears, sharp and angular objects must not touch the cover. The sled's cover needs to be pulled taut so that snow will not enter. Close the cover immediately after loading and unloading.

Fastening the Trace

Wind the strap twice around the trace to stop it from slipping sideways.

Closing the Cover

Carefully pull the cover taut before it is rolled. Lash the load tightly by criss-crossing the lashing rope from the lashing ring on one side of the sled to the other in the opposite direction from the way the cover has been rolled.



Securing the Cover

Use a slipknot because a normal knot freezes easily and becomes difficult to untie. The slipknot can be untied easily while wearing mittens by simply pulling the loose end.

Remember…

- Treat the sled's cover with care. A tear or a hole caused by a pole point allows snow and water into the sled.
- Do not put the trace and harness in the snow. They freeze easily and will become unwieldy when it is time to use them.
- Remove snow from the wooden sled's underside, otherwise the snow will turn to ice making the sled hard to pull.

Cooking Equipment

When preparing food or drink on a *field stove*, place the stove on a stable surface, for example, a Masonite board from an ammunition box (15x15 cm), so that the food container does not tip.

Methylated spirits (white spirit, methanol) are difficult to ignite in temperatures below freezing. In order to be sure that the burner will ignite in extreme cold, store the *methylated spirits bottle* (35 cl) in a pocket of your combat jacket.

Liquid in your canteen freezes easily if you are careless. Thawing a *canteen* takes a long time. It is important keep it warm, for example, by hanging it around your neck. Try to always fill it with warm water.

Cold food and drinks can cause stomach pains or contribute to hypothermia. The best way to keep a drink warm is to use a thermos.

CAUTION!

Don't touch metal objects in your cooking equipment with bare hands. It may cause local cold injury.

Load-Carrying Equipment

Load-carrying equipment has clips, straps and belts, etc. Be careful to keep these free of snow and ice so that they remain easy to handle. When putting load-carrying equipment down in the snow, place it backside up. Try to place it on a protective layer, for example, on spruce branches.

Combat pack and equipment with winter camouflage.

Sleeping Bags

Different units of the Swedish Armed Forces use many types and combinations of sleeping bags. Note that many units of the military do not have sleeping bags!

Remember...

- Create a thick insulating layer under your sleeping bag (spruce branches or a foam mattress). Put a lot on top of your sleeping bag (fieldjacket, thermaljacket). If the tactical situation permits wear as little as possible in the sleeping bag.
- Fluff air into your sleeping bag. Use the latrine. Make sure your body is warm before turning in.
- Protect your sleeping bag from perspiration by wearing dry underclothes. This is particularly important during long-term use.
- Protect your sleeping bag from external moisture.
- Avoid drying damp clothes and footwear in your sleeping bag.
- Do not cover the sleeping bag with material that may cause condensation, for example, plastic bags.
- Air out sleeping bag every day out in the field.
- Store the sleeping bag loosely rolled or hanging up when not in use.

Sleeping Bag System

Sleeping bag case/ Bivvy bag

Outer sleeping bag

Inner sleeping bag

PROTECTION AGAINST NBC AND INCENDIARY WEAPONS

Equipment	56
Detection	57
Decontamination	57

The effect of and protection against NBC and incendiary weapons differs during summer and winter.

The effects of climatic variations are negligible when dealing with nuclear weapons.

Usually, low temperatures decrease the speed of cell division in bacteria. For most types of bacteria, division stops at temperatures below 0°C. However, many types survive and may start dividing again if the temperature becomes favourable. Upon warming, they again become an active hazard to personnel. It is particularly important to maintain a high level of hygiene and be extra careful when handling food and water.

When the temperature drops, evaporation from liquid chemical agents decreases. In the winter this causes problems in establishing the boundaries of a contaminated area. It is important to keep this in mind when entering heated spaces, for example, vehicles, houses or tents. When the snow on equipment melts, it releases the chemical agents, bound there in, to harmful levels. Boots and pant legs will be the most contaminated.

The effect of incendiary weapons is limited during wintertime. Thanks to snow and cold, the risk of forests and vegetation catching fire is low. In urban areas, however, the risk of fire increases in the winter because buildings are heated and their moisture contents lowered.

Equipment

Protective Masks

Cold weather makes masks cold and stiff. Use your hands to warm up the mask, paying particular attention to the edges to ensure a snug fit. Check if the mask functions by placing your hand over the hole in the filter and inhaling.

The exhalation valve may be frozen, but it thaws out quickly when exhaling. Meanwhile, exhaled air is pushed out between the mask and the face. Gas-filled air does not enter the mask this way.

Avoid cold injuries! It is relatively easy to get cold injuries around the edges of the mask. Straps that are pulled too tightly reduce circulation. Pay attention to your fellow soldiers when you are wearing masks in low temperatures. Dry your face thoroughly after removing the mask.

Take great care of your mask. In case the mask is needed again quickly, make sure it is dried thoroughly. If the drinking attachment has been used, empty the tube of all liquid to prevent ice plugs. Hold the canteen with tube upward and blow out and suck in several times.

Autoinjector (Atropine injector)

Keep autoinjectors as warm as possible during below freezing temperatures, otherwise there is a risk of the antidote freezing. A frozen autoinjector can be used after thawing.

Ground Detection

1. *Scoop up snow and place in a collection bag.*

2. *Add warm water (evaporation begins).*

3. *Test the air. Make sure the detector is tightly enclosed in the opening of the bag.*

Detection

Detection is more difficult in winter conditions because of cold temperatures and low evaporation rates. *Nerve gas detection tag 90* should be warmed thoroughly so that it does not give false readings. In extreme cold, warm the tag, for example, in your armpit (outside of your liquid chemical protection clothing).

Detection personnel must wear liquid chemical protection clothing. In winter it may be sufficient to wear separate foot och leg protection if you are not going to be moving through dense vegetation.

Decontamination

It is certainly more difficult to carry out decontamination of a person during winter conditions. It is too cold to stand outside washing yourself and it is easy to be careless. Therefore, a heated area with washing facilities and warm water is recommended in order to achieve good decontamination results.

It is also good to have a heated room for re-clothing. If no water is available, perform a dry decontamination and rinse off the decontamination agent when water is obtainable. Test the snow for contamination before beginning the sanitization.

TROOP MOVEMENTS

Planning	60
Dismounted marches	63
Mounted marches	66
Considerations Before a March	68
Considerations During a March	68
Considerations During Breaks	68
Helicopter Transport	70

Troop movements during the winter are different from other times of the year. Ice and ground frost make it possible to cross water and bogs that otherwise would have been impassable. Ground frost improves bad gravel roads. Snow that fills in uneven terrain helps the advance of tracked vehicles and skiers.

Very deep snow slows the speed of advance for most vehicles and contributes to higher fuel consumption. Slippery and icy conditions slow down vehicles.

During the winter all types of transport should avoid rocky or hilly ground, slushy bogs and lakes. When skiing or skijoring, avoid sanded roads.

Planning

Before setting out, it is important to have as much information as possible about the route and the rest and reassembly points. These types of measures apply all the year round, but in the winter it is especially important to plan the route, making or faking tracks.

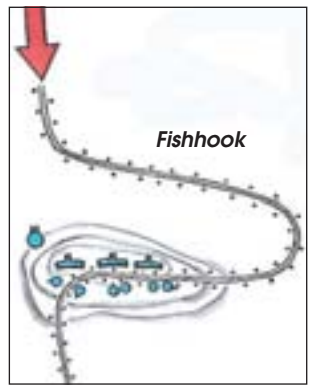
Route Finding

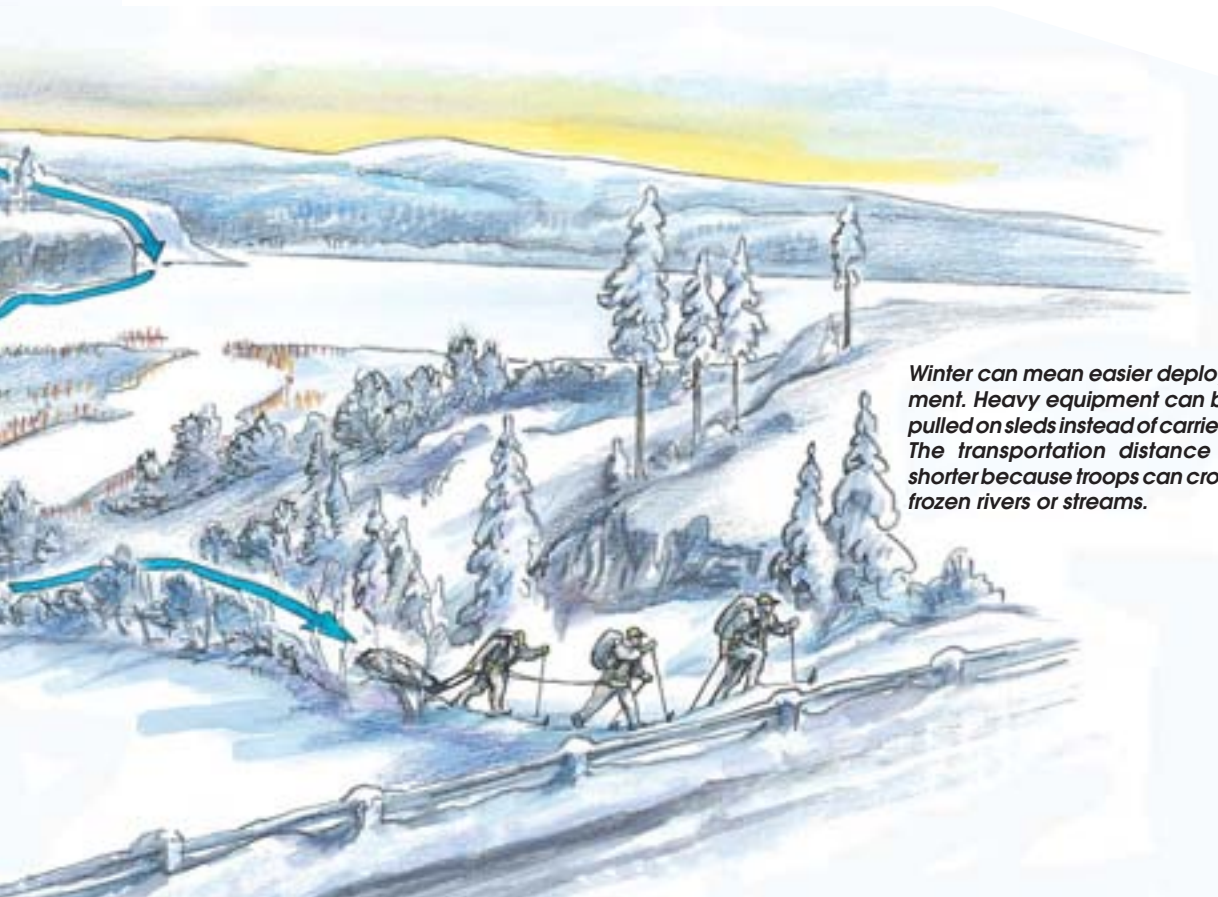
Carrying out a troop movement in winter without planning can result in so many tracks that finding the correct route to follow will be difficult. Remember that tracks in open terrain can easily be seen from the air.

Always try to make a *fishhook* when stopping for a long period. The hook allows the unit to be alerted to possible followers and facilitates a defence or a quick regrouping.

It is also important to choose a route that allows for easy retreat. Use distinctive orientation points and if necessary, mark the track.

Old tracks that are close to the enemy are a risk because they can be mined or lead into an ambush.





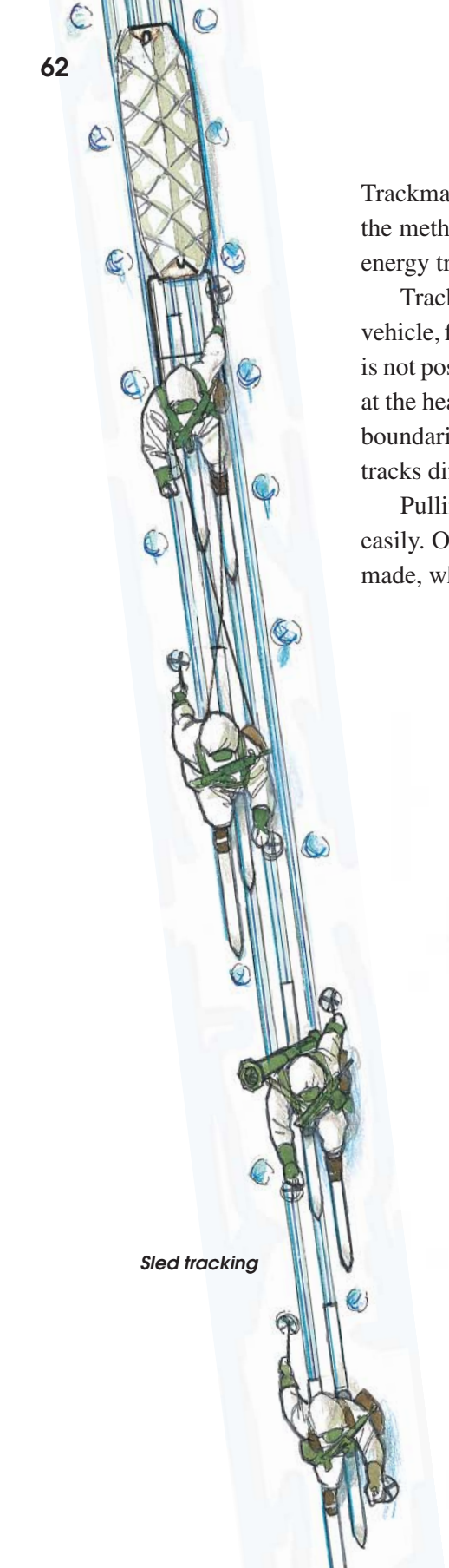
Winter can mean easier deployment. Heavy equipment can be pulled on sleds instead of carried. The transportation distance is shorter because troops can cross frozen rivers or streams.

Making Tracks

Trackmaking in the snow is energy draining, irrespective of the method. The deeper or wetter the snow, the more fuel or energy trackmaking will use.

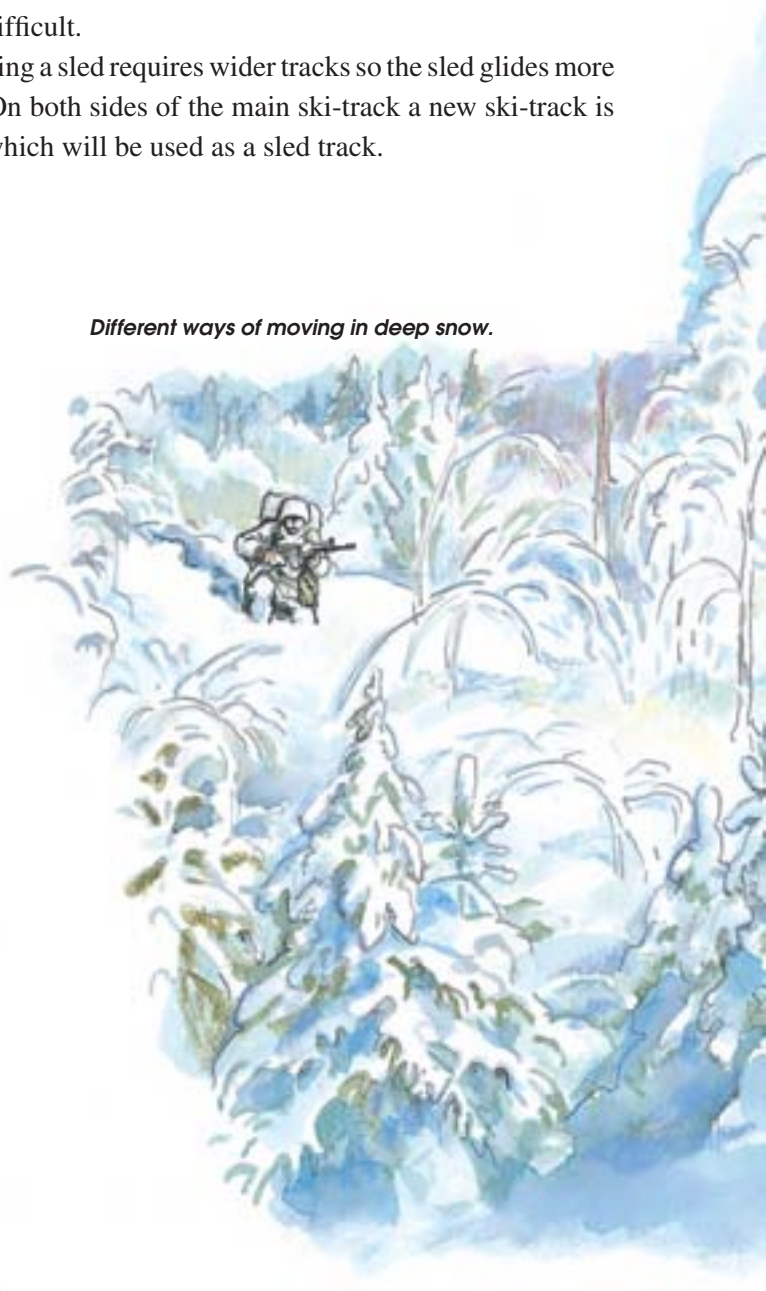
Trackmaking is considerably easier when done using a vehicle, for example, a tracked vehicle or a snowmobile. If this is not possible, detail a group that will take turns trackmaking at the head of the column. Use hedges, fences, ditches, forest boundaries and other terrain features to make the detection of tracks difficult.

Pulling a sled requires wider tracks so the sled glides more easily. On both sides of the main ski-track a new ski-track is made, which will be used as a sled track.



Sled tracking

Different ways of moving in deep snow.



Faking Tracks

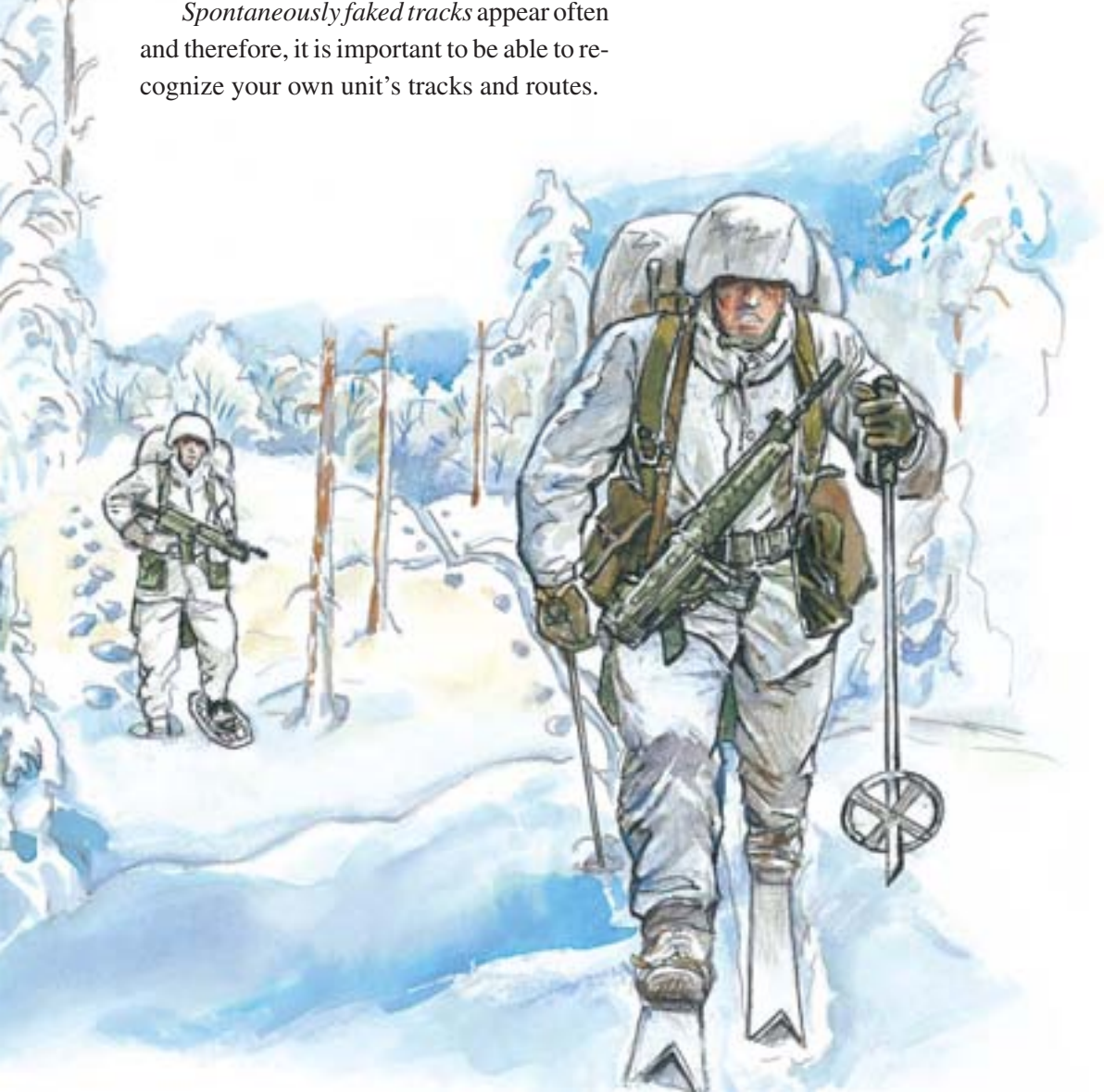
There are two types of faked tracks: planned faked tracks, which are coupled to a task and spontaneously faked tracks, which are made by many units, either ally or enemy, moving through an area.

The main purpose of *planned faked* tracks is to confuse in order to protect a regrouping after a mission or to conceal preparations before an attack. Extensive faked tracks take a long time to create.

Spontaneously faked tracks appear often and therefore, it is important to be able to recognize your own unit's tracks and routes.

Dismounted Marches

It is possible to carry out dismounted marches in winter but mobility is limited, particularly if the snow cover is deeper than 50 cm. To aid winter dismounted marches, there are short skis, ordinary skis, and snowshoes. Sleds are used to carry equipment. To be able to use these correctly, a command of basic techniques is required.

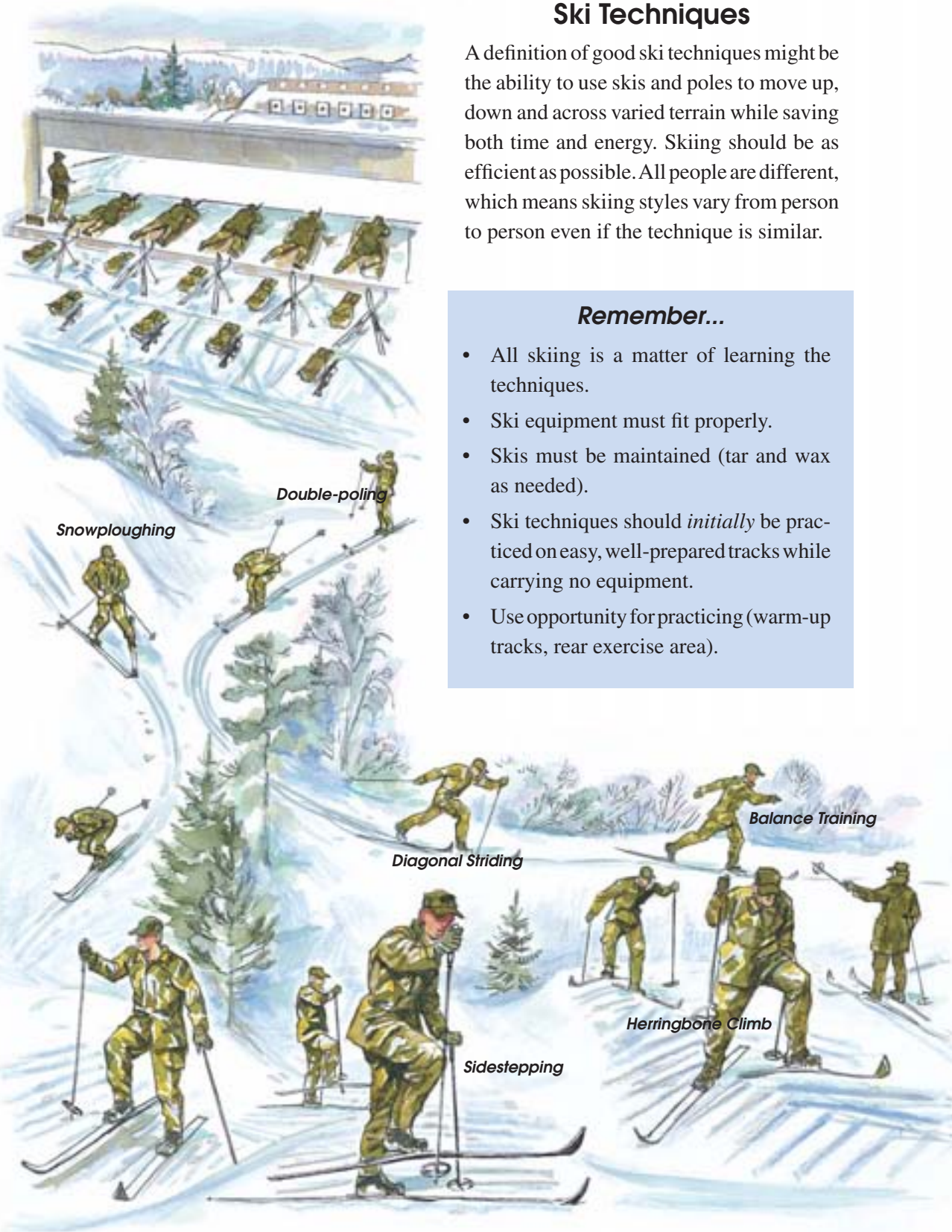


Ski Techniques

A definition of good ski techniques might be the ability to use skis and poles to move up, down and across varied terrain while saving both time and energy. Skiing should be as efficient as possible. All people are different, which means skiing styles vary from person to person even if the technique is similar.

Remember...

- All skiing is a matter of learning the techniques.
- Ski equipment must fit properly.
- Skis must be maintained (tar and wax as needed).
- Ski techniques should *initially* be practiced on easy, well-prepared tracks while carrying no equipment.
- Use opportunity for practicing (warm-up tracks, rear exercise area).



Pulling Sleds

Generally, pulling a sled requires two people. It is important that the pullers use the terrain to their advantage so that they do not become tired. The rest of the unit prepares a good sled track without any sharp bends or passing through dense vegetation. The pullers must be relieved often.

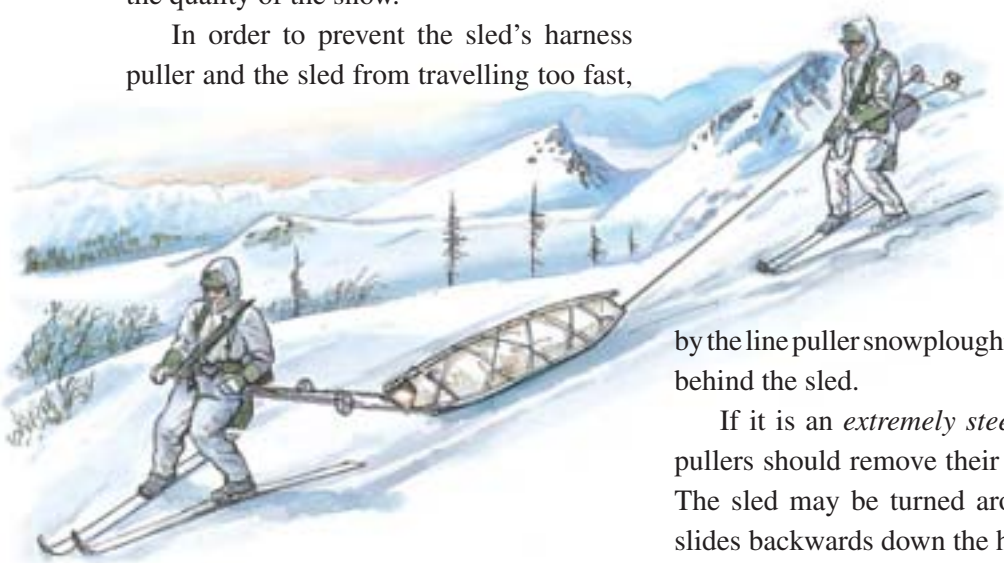
When *ascending a hill*, the pullers might be required to herringbone or sidestep. Additionally, another person can help by using his pole to push the sled from behind. When the sled is heavily loaded and/or the ascent long, the pullers have to zigzag to save energy. Avoid sweating by taking several short breaks of not longer than a minute when the situation allows.

Coupled pulling lines.
Wear the pulling harness low on the hips.
Make sure that ski poles do not puncture the cover when they are used to push the sled from behind.

When *ascending very steep hills* with a sled, the pullers should walk and the sled be pulled up the hill with the help of the pull lines.

When *descending a hill* with a sled, choose a technique based on the skiing skills of the pullers, the length of the descent and the quality of the snow.

In order to prevent the sled's harness puller and the sled from travelling too fast, the line puller should detach himself while the harness puller grips the front part of the harness to increase balance and stability. This will make it easier to turn and control lurches. The sled can be slowed down by the harness puller snowploughing during the descent. Additional braking can be obtained by the line puller snowploughing and braking behind the sled.



If it is an *extremely steep descent*, the pullers should remove their skis and walk. The sled may be turned around so that it slides backwards down the hill.

Leather Facemask

Mounted Marches

Soldiers (commanders, air scouts, snowmobilers and motorcyclists) driving or travelling in open vehicles in the winter must be very conscious of the windchill caused by the speed of the vehicle. Dress warmly and wear face protection!

Reinforce clothing against the windchill by putting newspapers or plastic bags inside your combat jacket and over your knees and groin. It is also important to protect yourself against dampness and the contact cold from saddles, seats and truck beds. Insulate them with ground sheets, Styrofoam, spruce twigs, or straw.

A driver, who sits in a tracked vehicle used for skijoring or a snowmobiler, who is protected against the cold wind, must adjust the vehicle's speed to suit the skijoring team's equipment.

When you are travelling or skijoring, it is important to maintain blood circulation by slapping your arms against your sides or windmilling.

When there are stops for rest or break periods, make sure to move around – slap your arms against your sides or go for a short run.

'Tunnel' Facemask

Motorcycle/Snowmobile Facemask

Skijoring

Skijoring is when skiers are pulled by a vehicle.

The harmful effects of the windchill factor are increased by the cold temperature and the speed of the vehicle. Blowing snow that remains on a face further increases the risk of cold injuries because it melts and makes the skin damp.

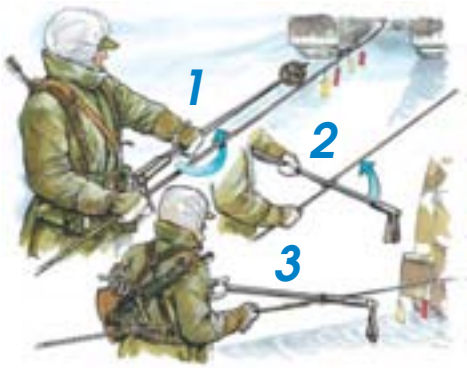
It is also very important to put on more clothes. Do not forget to protect your face with, for instance, the balaclava. During long skijorings, increase insulation to groin and stomach with a piece of cardboard, a plastic bag or a newspaper.

CAUTION!

Read the skijoring section in Säkl Trafik (Military Safety Regulations: Traffic)!

Preparing for Skijoring

Take up positions at the joring line and connect the poles. Keep the poles under your arm, grip them with one hand and grip the line with the other. Make sure that your weapon does not touch the joring line. The first man should be at least 6 m behind the vehicle.



Moving Forward

When the vehicle starts, take a couple of gliding steps on your skis so that you begin to move. Keep the skis slightly pushed forward, stand straight and lean slightly backwards. Relax and flex your knees and hips. Be aware of the signs and signals from the skijoring controller at all times. Snowplough to control speed. Be prepared to let go of and steer away from the joring line if someone in front of you falls.

Pull/Push Right or Left

When turning left or right in curves, it is very important for *everybody* to help control the joring line by pushing or pulling it. Otherwise, the whole team risks being pulled into the deep snow or into a tree.

Stopping

Stopping takes place after a reduction of speed.

Releasing

Let go of the joring line to start skiing or doing something else.

Ready for skijoring

1. *Put poles parallel to the joring line.*
2. *Make a half hitch.*
3. *Make sure the hitch is next to the 'handgrip'.*

Forward

Pull/push right/left

Stop

Release

CAUTION!

Be aware that a vehicle's speed increases the effect of the cold. See table on p. 14.

Considerations Before a March

- Organize and check your gear.
- Arrange warm food and drinks that do not require cooking and keep them easily accessible.
- Organize and adapt clothing to the type of transport and to any special tasks, for example, air scout/observation duty.
- Be prepared to quickly and easily put on extra clothing such as the fur hat or the thermal jacket.

Considerations During a March

- Check your and your colleagues' gear regularly. Check each other for cold injuries. This is not only particularly important when skiing and skijoring, but also when soldiers are exposed to wind (air scouts/observators, motorcyclists and snowmobilers).
- Always step off the track whenever you are forced to stop, for example, during rest breaks. This way, other units, commanders and messengers pass unhindered.
- Alert your commander if you or your colleagues have problems with gear or cold injuries.
- Alternate between skiing and skijoring in order to keep warm in extreme cold.
- Do not forget to relieve soldiers, who are exposed to the weather.

Considerations During Breaks

A break can be short (10–15 min) or long (should be 60–90 min). During extremely cold weather, it is better to have shorter breaks at shorter intervals. This reduces the risk of hypothermia. Breaks depend on the time available for a mission.

Remember...

- Leave the track and take cover. Set up your firing position with your combat partner.
- Put on extra clothes.
- Drink something warm and eat some dry rations. The commander will decide whether warm food will be served or not.
- Never sit directly on the snow. Sit on gear, spruce branches or a Styrofoam mattress instead.
- Check gear, equipment and clothing. Immediately attend to equipment problems or small injuries, for example, blisters.
- Change wet clothing.
- If making a fire is permitted, then take the opportunity to dry wet and damp clothing. Take the chance to boil water for thermoses and canteens.
- Do not forget to remove all the extra clothing before the march continues.

Helicopter Transport

Preparing the Landing Point

A landing point should be chosen so that it is hidden from direct view, for example, by forests or hills, and should be obstacle free in the direction of take off and landing. It should be situated in the shade. The landing point should be as level as possible and not have more than a 5–6° incline. Each helicopter requires a landing point of 15x15 m, with 50 m between each point.

Make sure that the landing pad is free from loose objects, which could dislodge and become entangled in the main or tail rotors. A helicopter's downwash is very strong at take off and landing. Empty stretchers, sleds, skis, poles or other gear must be stored and well secured at least 10 m from the landing point. The landing point should be trampled or levelled with snowmobiles, tracked vehicles or skis to reduce the risk of an uneven point.

Receiving a Helicopter

The Marshaller marks the landing point for the helicopter. He must have the wind at his back and raise his arms in the direction of the incoming landing. To steady himself he must place one knee on the ground.

Blowing snow reduces the visibility to such an extent that the Marshaller the only reference point the helicopter pilot has. Therefore, the Marshaller must remain still and keep his arms raised until the helicopter has landed. The helicopter will land only a meter from the Marshaller. The Marshaller must wear ear protection and have suitable clothing adapted to the windchill and to the blowing snow. *Caution! The Marshaller must remain still.*

Loading and Unloading a Helicopter

The danger zone around the helicopter is 10 m (from the tips of the main rotor blades plus 3 m and from the tips of the tail rotor blades plus 5 m). Note that the tail rotor cannot be seen if there is a lot of blowing snow. Approach and leave the helicopter from the front so the helicopter pilot can see you. Skis are to be pulled to the helicopter. If they are carried, there is a risk that they will come in contact with the rotor blades. If a sled is to be loaded, the trace needs to be stowed underneath it. Lay the sled on its side and fold the trace beneath the sled. This stops the trace coming in contact with the rotor blades.

FIELD WORK

Camouflage	74
Faked Tracks	74
Fortifications	75
Crossing Frozen Waterways	76
Field Work	79
Blasting	80
Mining	80
Mine Detection and Clearing	81

When bogs and waterways freeze, the possibilities of advancing with combat vehicles increase. A careful reconnaissance must be made before crossing a frozen waterway with a heavy vehicle.

Sometimes, combat vehicles advance more easily in the winter than in the summer because of the snow cover's ability to smooth out uneven terrain. Combat vehicles advance easily in snow that is 60–70 cm deep. A unit's tracks are more visible in the winter, which makes detection easier.

During the spring, when the snow has melted and the ground has thawed, it may be impossible to advance using combat vehicles on gravelled roads and across the surrounding terrain.

Camouflage

The snow camouflage safeguards against detection.

The need for camouflage increases in winter when dark contrasts are more visible against the snow and when protection provided by vegetation is reduced. Newly fallen snow can hide tracks and acts as good camouflage for, for example, minefields.

When it is necessary to remove snow in order to build snow emplacement or to dig a trench to the tents, be careful to leave at least 10 cm of snow on the ground for camouflage. Level off the edges to avoid shadows.

If the unit only has green camouflage netting, white camouflage paper or white material can be woven into the netting to improve the winter camouflage.

Faked Tracks

Track making is a problem that must constantly be kept in mind. One way of concealing your own activities is to make faked tracks. Use faked tracks to confuse the enemy about, for example, which direction you are travelling or where you have laid mines.

Fortifications

To build fortifications, for example an armpit trench, when there is ground frost is difficult and often requires blasting. Follow these instructions:

- Remove snow.
- Make a hole for the charge in the middle of the place where the emplacement is going to be.
- Load the hole with half a staff of plastic explosives.
- If the ground frost is not broken the first time, try again.
- Dig away the frozen surface and break up the ground gradually.

Do not load the hole with more than half a staff of plastic explosives since it increases the risk area and the area that becomes blackened by the earth thrown up by the blast. Snow may fall from the trees around the blast site.

Snow Trenches

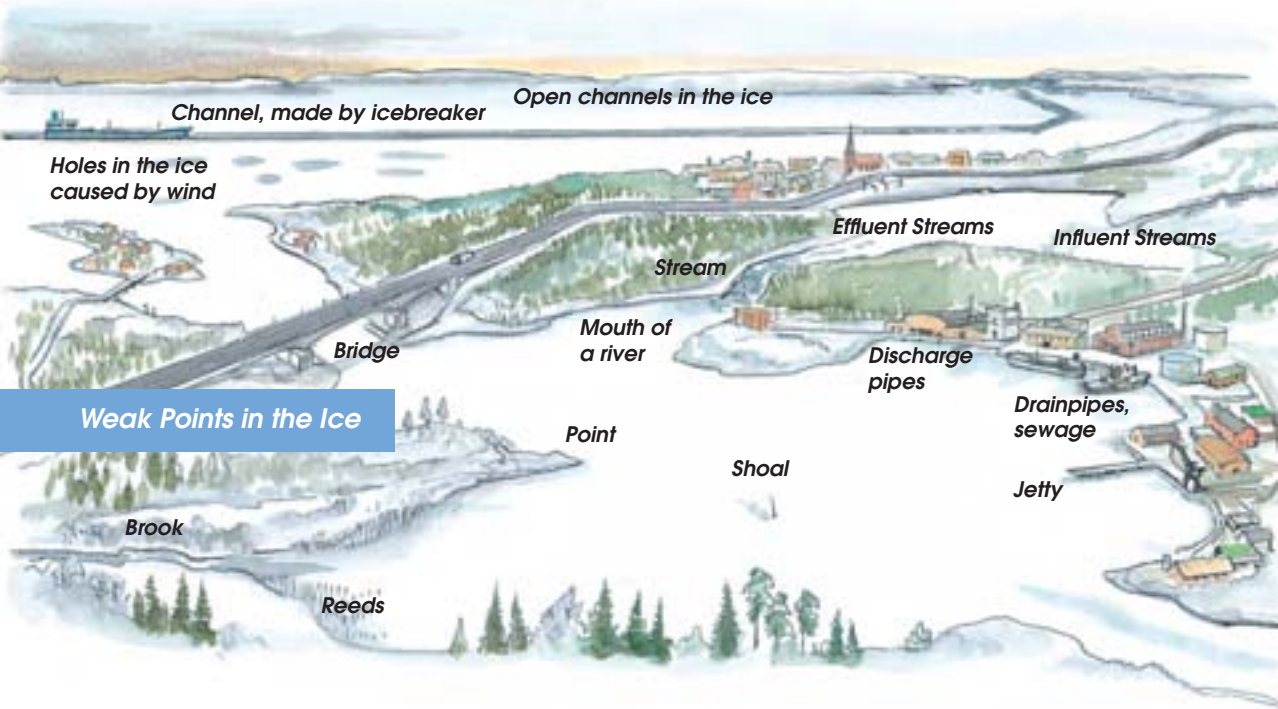
When there is sufficient snow, a snow trench can be built. For protection against small arms fire, the wall must be made of packed snow at least 2 m thick. It is important that the snow is packed properly so that it can freeze. The length of time it takes to freeze depends on the temperature.

Crossing Frozen Waterways

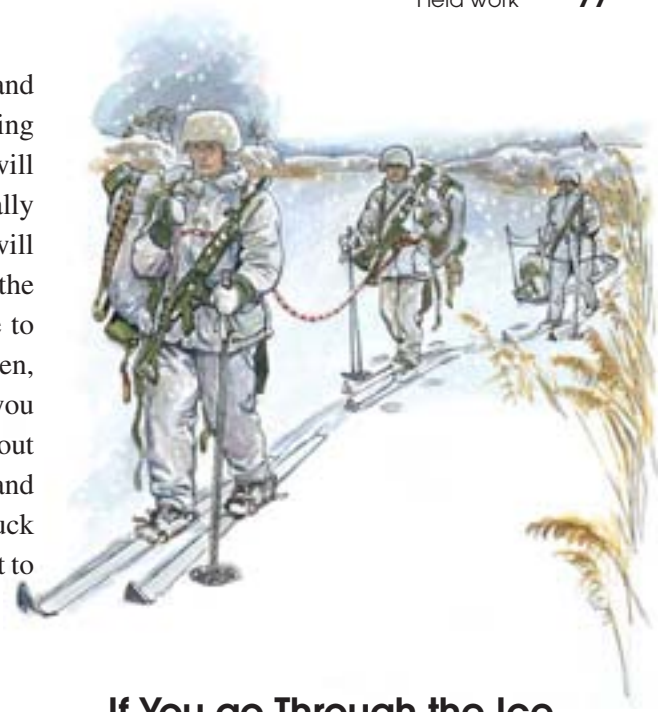
WARNING!

Do not stop vehicles on the ice.

Lakes and waterways can be traversed if the ice is thick enough and is of good quality. The table below shows how thick the ice needs to be in order to safely cross a frozen waterway when there is good quality ice (clear ice). Read *SäkI Övergång av vattendrag (Safety Regulations: Crossing Waterways)!*



	Total Weight	Required Safety Ice Thickness	Minimum Distance Allowed	Minimum Speed Allowed	Maximum Speed Allowed
	150 kg	5 cm	5 m	-	-
	500 kg	10 cm	50 m	-	-
	6,5 ton	30 cm	50 m	3 km/h	20 km/h
	12 ton	40 cm	50 m	3 km/h	20 km/h
	22,5 ton	55 cm	50 m	3 km/h	20 km/h
	65 ton	90 cm	50 m	3 km/h	20 km/h



As a *solitary* soldier with combat gear and skis you have very little chance of getting out of a hole in the ice. With skis on you will get far out on the thin ice before it finally breaks. Consequently that the thin ice will break as you try to drag yourself out of the water. You need to struggle a long time to reach ice that will bear your weight. By then, you will be so exhausted and frozen that you will have great difficulty pulling yourself out of the water. Your combat gear, weapon and skis area hindrance, which easily get stuck in the edge, making it even more difficult to extract yourself.

Preparations

If a unit *must* cross ice, which has not been reconnoitred, then they should let the group's heaviest soldier go first. He should have a 10 m long safety line around his chest (for example, a sled's pulling lines or a joring line). The first man should not wear his combat vest belt but attach it to his rucksack.

All soldiers should:

– Ski with bindings undone.

– Hold ski poles without putting their hands through the straps.

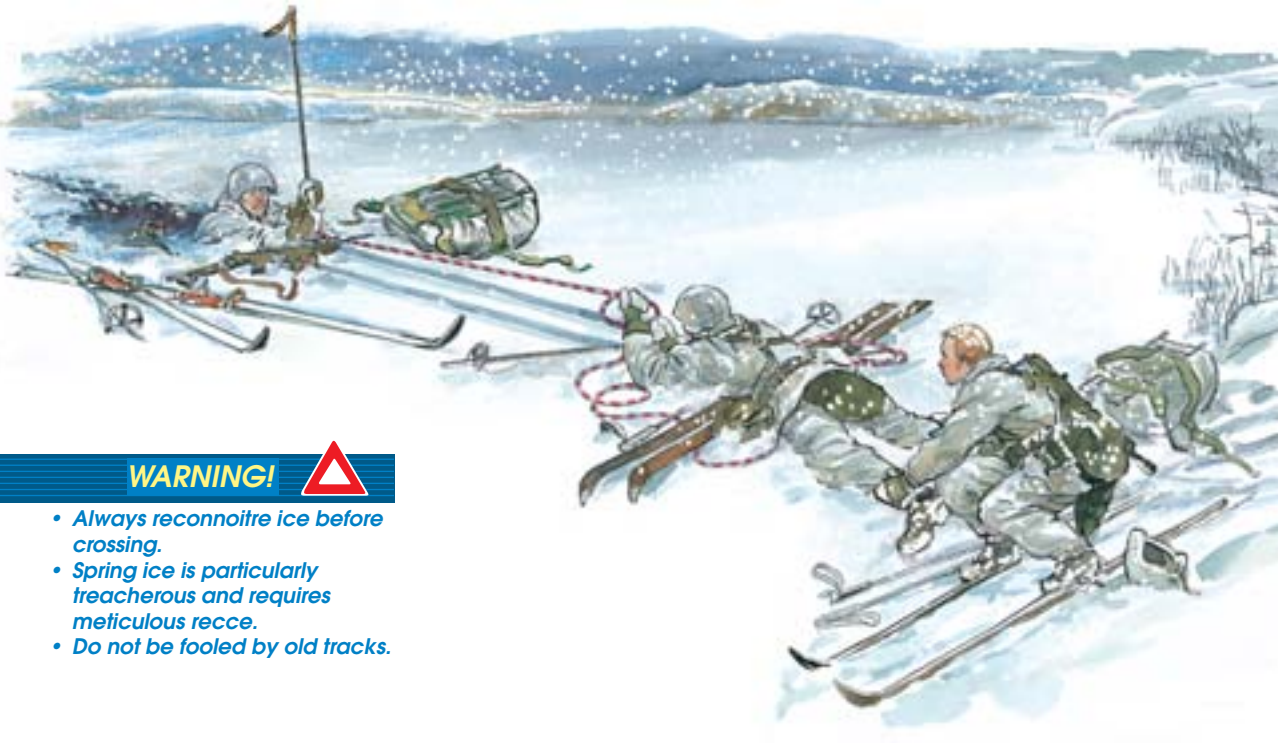
– Carry rucksacks on one shoulder. If the rucksack is heavy, it will be difficult to climb out of the water. Its weight will cause the ice to break.

– Carry their weapon around their necks.

– Sled pullers pull the sled by holding the shaft with your hands.

If You go Through the Ice

- The first thing to do is turn around so that you face the direction you came.
- After 10–15 seconds, the cold water will have gone through your clothing and your heart will start pounding violently. This is the body's attempt at trying to warm the cold skin. The heartbeat decreases after a while and it is then vital to get out of the water quickly.
- Take off your skis. Try to get them out of the water first (without skis you will find it hard to move on the ice).
- Take off your gear and try to heave it up onto the ice, as far from the hole as possible. Start with the weapon and then the rucksack.
- If the ice is thin and breaks, it may be necessary for a couple of soldiers to help you out of the water.



WARNING!

- *Always reconnoitre ice before crossing.*
- *Spring ice is particularly treacherous and requires meticulous recce.*
- *Do not be fooled by old tracks.*

- The soldiers who are helping must lie down across their skis and keep the line taut.
- Kick strongly as if you are swimming and try to force yourself above the edge off the ice.
- A ski pole can serve as an ice-prod.

Treatment After an Accident

Someone in the group prepares the treatment.

- Lay out a Styrofoam to stand on. Find extra undergarments and socks, thermal jacket, woollen sweater and thermal trousers.
- If possible, start a fire on the beach.
- Help remove shoes and clothing.
- Give him a warm drink and make sure he starts to use his muscles, for example, by slapping his arms against his sides or by running around on a ‘warm-up track’.

Field Work

When many tracked vehicles are required to drive one after the other in the same direction, it is important that they do not drive on the same track. They need to overlap each other's tracks in a *'carpet pattern'*. This kind of track lasts longer and makes travelling considerably easier for ski joring soldiers and snowmobilers who take up the rear.

Large ditches can be a hindrance for vehicles, but you and your unit can build a snow bridge quite easily. The bridge is built of snow and bundles of sticks, bound at both ends and then covered with snow.

If there is running water in the ditch, make sure there are enough bundles at the bottom to let the water pass through (prevent damming).

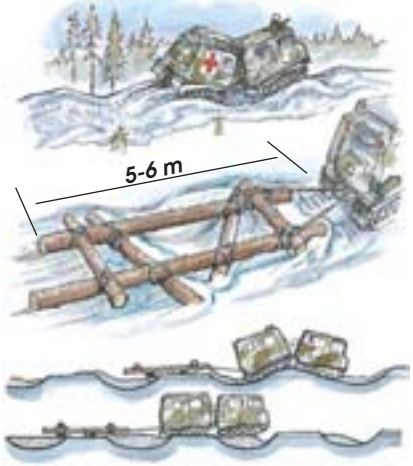
Carpet pattern

Making double-bound bundles

Snow bridge built with bundles

CAUTION!

Drive at a low and constant speed to maintain the track.



Maintaining Tracks

Roads made by tracked vehicles that will be used for a long time, for example, as supply lines, will soon become bumpy. The more traffic that passes over the road, the bumpier it becomes until finally the track becomes unusable. One way to maintain the track is to build a 'skid' of logs. The skid must be made of heavy wood, approx. 5 m long, in order to even out the track.

Blasting

Plastic explosives harden in the cold and when handled, they can crumble. If you have been given a blasting task, try to keep the explosives warm. Find a warm space such as a vehicle. Do not warm explosives over open fire.

Some explosives, for example, Dynamex, are more difficult to ignite in the cold. If the temperature is below -20°C, make a detonator from plastic explosives to ensure that it will ignite.

Tape hardens in the cold. This makes it difficult to tape knots and prime percussion caps on the detonating cord. Keep the roll of tape warm by putting it in your trousers' pocket. Just before you need it, cut off the lengths you need and stick them to your wrist.

To prevent snow and ice from blocking the spring percussion igniter, mount it with its mechanism downwards.

Mining

When placing anti-tank mines in deep snow (more than 50 cm), the mines should not be placed directly on the ground. Before positioning a mine, pack the snow by stepping on it or by dropping the body of the mine onto it a couple of times.

The packed area should be double the size of the mine's diameter in order for the mine to remain stable and not tip over when a vehicle drives over it. If the snow is frozen, camouflage the mine with snow. If the snow is wet or if there is a risk of

mild weather, the mine must be covered with camouflage paper or spruce branches before it is camouflaged with snow. Otherwise, the fuse will freeze and not function. Mines painted white decrease the risk of detection.

Anti-tank mine 6 and *anti-tank mine fuse 16* must not be covered with too much snow. When placing these types of mines, remember to place the upper part of the mine or the fuse as close to the ground or snow surface as possible. This prevents new snow from blocking the fuse.

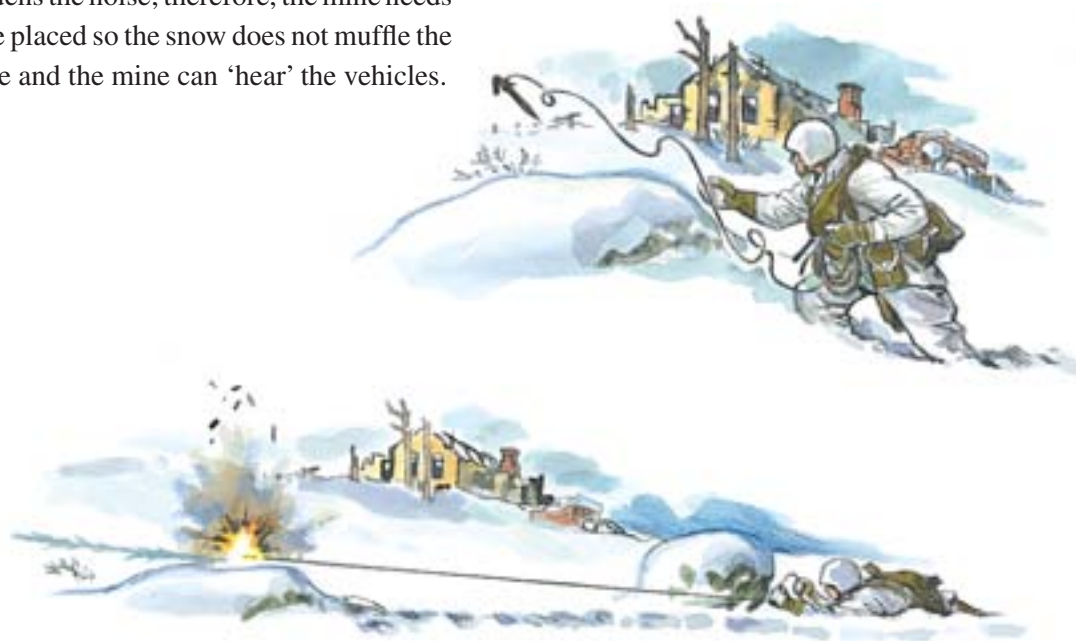
All types of *directional mines* must be placed so that the snow does not hinder the trajectory of the projectiles or bullets. If the mines are to remain in place for a long time, it is important to place them high enough so that more snow or snow banks do not reduce the effect.

Directional mines with sensors react to noise made by combat vehicles. Snow deadens the noise; therefore, the mine needs to be placed so the snow does not muffle the noise and the mine can 'hear' the vehicles.

Mine Detection and Clearing

Carrying out mine detection is very difficult in winter, especially after a snowfall. Detection is carried out using the same methods as when there is no snow on the ground.

If you are looking for mines in undisturbed snow, first of all make sure that there are no mines with trip wires. Use a throw line with a weight on the end that will sink into the snow. Pull the line back towards you. Then probe in squares of 1x1 m along the track made by the line. Be sure to probe and dig all the way down to the ground.



REST AND RECOVERY

Avoiding Detection	84
Protection Against the Effect of Fire	85
Bivouacking	86
Guard Duty	90
Bivouacking in Combat	91

To bivouac a unit in winter requires a lot of work if the rest is going to be sound. The ideal place is a house that can be heated. Even if there is only room inside the house for part of the unit, it should be given preference over tents.

If possible, try to find a place where there is access to plenty of wood, spruce branches and water.

Avoiding Detection

It is very difficult to hide a unit's winter bivouac. Aircraft, helicopters, unmanned aerial vehicles (UAV) and satellites are equipped with optical sights, night viewing aids and thermal weapon sights and can easily make out tracks, warm tents and vehicles. A camp can even be exposed by smoke, which remains over a bivouac area in intensely cold and windless weather.

Your commanding officer decides how the tracks in the camp will be laid out in order to minimize the risk of detection. Track discipline must be maintained at all times. Faked tracks and faked bivouac sites are two alternative options.

To protect against thermal weapon sights is very difficult in winter because of the big temperature differences between heated tents (warm vehicles) and the air temperature. Dense spruce forests offer some protection. A thick layer of spruce branches can camouflage small tents. The unit should use thermal covers if they are available. It is possible to protect the unit somewhat by bivouacking them in a spread out fashion. The enemy might judge each separate bivouac site not worth the effort to launch air attacks or start shelling.

If there is a risk of smoke remaining over the site, the commander must decide if the unit needs to leave the area before dawn.

Smoke can expose a bivouac site.

Protection Against the Effect of Fire

In winter it is possible to travel cross-country. Therefore, it is important to be well aware of the enemy's ground activities. When there is a lot of snow, combined with falling snow and wind, the guard on duty might find it difficult to hear advancing combat vehicles.

If nothing else has been ordered, firing positions for close range defence of the bivouac site must be arranged along the snow bank that was made when the tent sites were cleared. Anti-tank weapons must be emplaced in such a way that neither the tents nor the soldiers end up in the hazardous area behind the weapons.

The tents should be dug as deep into the snow as possible. This give them some protection against both shelling, shrapnel and aimed weapons.

Anti-tank weapons, kept in their firing positions, need to be protected against snow and damp. Put them in sleds, or on spruce branches covered by camouflage paper or rainwear.

Each man must keep his small arm inside the tent against the wall above his head so that it is easily accessible.

Bivouacking

It takes longer to set up a bivouac in winter than during the rest of the year when there is no snow on the ground. This places great demands on the commander, who is required to lead the unit, delegate the work and consider all eventualities. It is the commander's responsibility to see that enough firewood and spruce branches have been gathered so that when the site is ready, the soldiers' rest will be sound, thus improving combat performance.

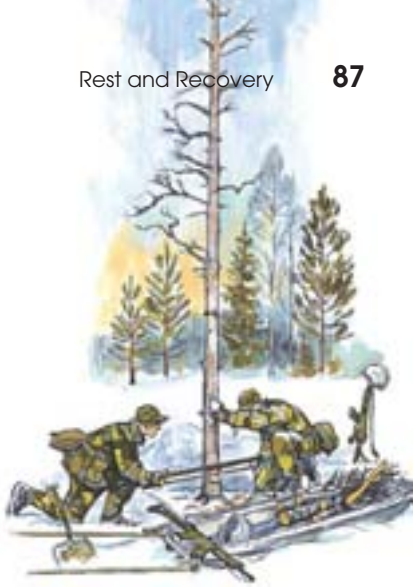
Gather ample spruce branches for the tents – the effort will pay off. If there are too few branches under your bed, the cold will seep up and you risk spending the night freezing instead of sleeping. Leave at least 10 cm of packed snow under the branches as further insulation.

When the tent stove is lighted, it requires oxygen to burn – make sure that oxygen can enter through the tent opening.

To avoid draughts, the tent's ground valances should be turned outwards and snow placed on top of them.

In order to stop the snow from freezing to the snow valances, cover them first with branches or camouflage paper and then shovel the snow on top.

To allow oxygen to enter the tent, put some logs in the tent opening.



Firewood

Gather and chop sufficient firewood for the night. A big sack (approx. 200 litres) filled with chopped wood (kindling size) is enough for one night. Pine trees, which have died upright (dry pines), are not only the easiest type of trees to find, but also provide the best heat. These trees have partially or completely lost their bark and are grey and cracked. At a pinch, frozen birch or alder wood can be used. This presupposes that there already is a proper fire with plenty of embers.

Drying Clothes

Before entering a warm tent, it is important to brush off snow from your clothes and equipment. Pay particular attention to your footwear. The snow will melt when you enter the warm tent and a lot of time will be wasted drying your gear. There might not be enough time to dry everything and you might end up having to put on wet or damp clothes when you leave the bivouac.

Remember...

- Do not dry all your wet clothes at the same time. There must be room on the drying rack for everyone's clothes.
- Dry socks and mittens first and make sure to hang clothes only on your side of the rack.
- The tent leader decides whether or not you are allowed to dry your snow jacket and trousers. The best opportunity to do this is during your fire watch.
- Do not put shoes or boots so close to the stove that they risk becoming deformed by the heat.
- Do not forget to dry the insoles. Stand them up inside the boots so they do not get lost.

WARNING!

A Word of Warning About Overheating!

If it is very cold outside, the fire must be kept burning so that the tent remains warm. The clothes hanging next to the stove and chimney risk becoming overheated and may *catch fire spontaneously*. The upper part of the tent might spontaneously ignite for the same reason. This happens very quickly. The person on fire watch must be mindful of overheating.

Storing Equipment

Both personal and group equipment must be kept in order. If a small item is lost in the snow or something is left outside when it is snowing, it may be difficult to find.

A good rule is that personal equipment must only be stored in three places: on you, in your hand or in your rucksack.

Remember...

- Set up a ski rack near the tent if skis are going to be used that night or next day.
- Skis and sleds should be free from snow and put in racks or placed on branches to prevent them freezing to the snow.
- When not in use, common equipment should be loaded onto a sled or put into a vehicle.
- Combat equipment is stored at firing positions or in vehicles.
- Bring only your combat pack and other necessities for the night into the tent.
- Thermal jacket pockets are so large that you can keep a pair of underwear, a mug and your toiletries in them.

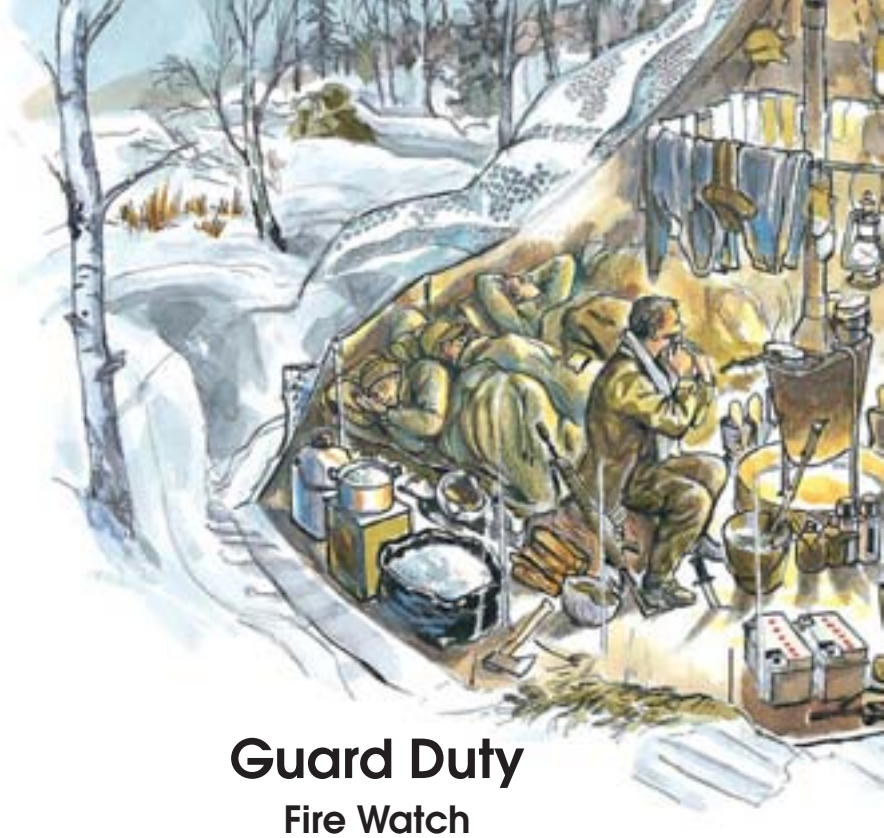
Rest

If rest and the recovery are going to be effective, every soldier must be given the opportunity to replenish the body's need for energy and liquids. A soldier should strive to eat and drink before resting.

When resting and recuperating, it is important to take every opportunity to maintain personal hygiene. Good hygiene not only prevents infections, but also has a positive psychological effect.

Remember...

- Make it a habit always to have water available at the bivouac site for drinking and tending to your personal hygiene.
- Refill water cans, canteens and thermoses.
- If there is no water, use snow. Fill a plastic bag or the tent bag with clean snow. At night, the person on fire watch will melt the snow and fill the canteens.
- Always plan to have warm drinks and dry rations in the bivouac for cold guards and patrols.



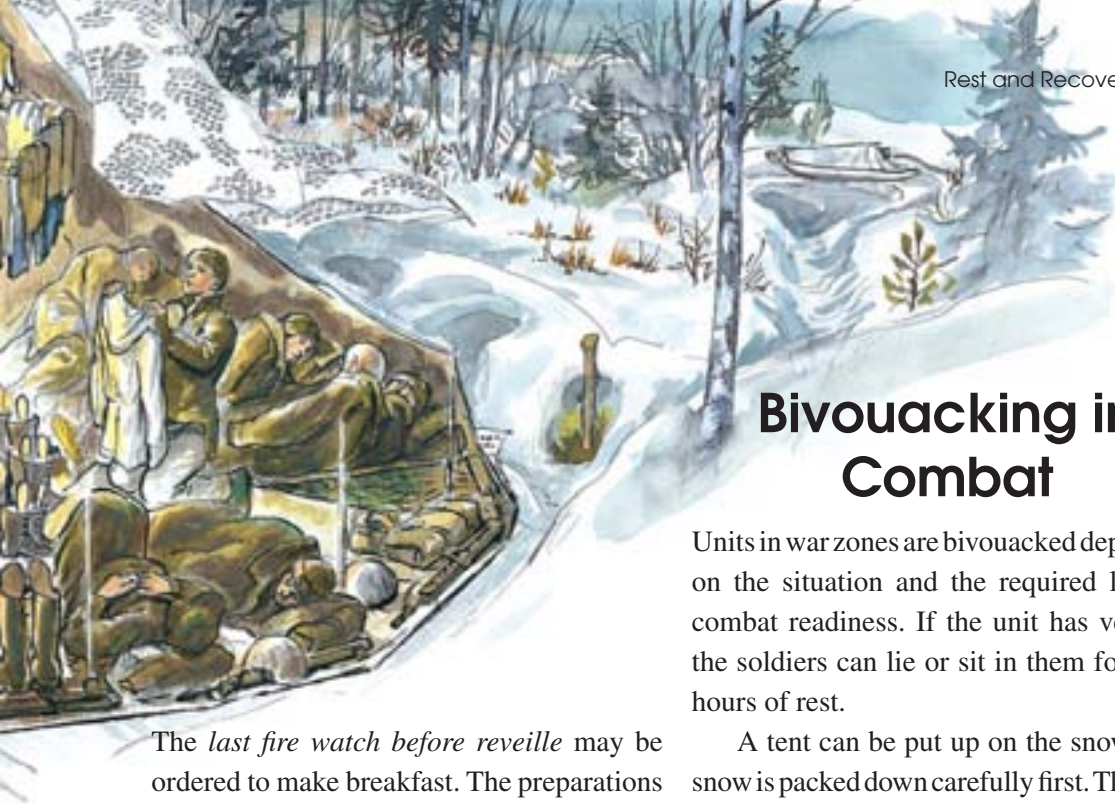
Guard Duty

Fire Watch

Besides following the regulations in *SoldF (Soldier´s Field Manual)*, the fire watch in a winter bivouac should be particular about the following:

Remember...

- Keep the fire burning and maintain a constant temperature in the tent.
- Move the clothes around on the drying rack so that they dry quicker. Remove dry clothes. Watch for overheating!
- Make sure that the clothes and boots of sleeping soldiers do not come in contact with the stove.
- Cover sleeping soldiers, if their covers have slipped off.
- Fill the canteens with water and the thermoses with warm drinks.
- Wash your genitals. Shave. This is a good opportunity because you are undisturbed and have warm water!
- To avoid draughts make sure there is enough air entering through the tent opening.



The *last fire watch before reveille* may be ordered to make breakfast. The preparations must be done the evening before. The troop's kitchen or pots must be prepared. Enough ingredients must be set out and sufficient water must be available and properly boild.

Guards/Sentries

As a guard you must dress warmly so that you can stand still and concentrate on your tasks. Use the thermal jacket and trousers and make sure that you have dry socks, boots and insoles. Insulate against the ground cold by standing on a thick layer of spruce branches.

In intense cold, the guard should be on duty for no longer than 20–30 minutes. The colder it is, the more frequently the guard must be relieved.

The fire watch and the outside guard should alternate a couple of times before the next set of guards come on duty. Relieving each other saves the need to wake those, who are sleeping until their proper time for guard duty.

Bivouacking in Combat

Units in war zones are bivouacked depending on the situation and the required level of combat readiness. If the unit has vehicles, the soldiers can lie or sit in them for a few hours of rest.

A tent can be put up on the snow if the snow is packed down carefully first. The snow can be packed down by skiing or by driving a tracked vehicle back and forth over it. Use ski poles as tent pegs. Stabilize the stove using pieces of firewood to prevent it from sinking into the snow.

When bivouacking in combat, you are often on high combat readiness and therefore, you must not take off any clothes. Be extra conscious of the risk of cold injury; the feet are particularly vulnerable.

Keeping Warm

The commander decides if fires are allowed. If they are, the fire should be well screened. When fires are not allowed, there must be warm drinks in canteens or thermoses available. Another option is to get permission to prepare warm drinks and food in a troop kitchen or on a field stove.

Arranging a 'warm-up track' where you can move around and slap your arms against your sides is a good way to keep warm.

COMBAT

Preparations	94
Movement Techniques	96
Firing Readiness	99
Firing Points and Firing Positions	100
Mechanised Unit	102
Caring for the Injured	103
Breaks in Battle	104

As much as possible, winter combat techniques should mirror those used during the rest of the year. However, you must learn how to aim and fire well and take cover quickly while wearing skis and using ski poles. The snow and cold require that you take extra care to dress properly.

The depth of the snow affects fragmentations and smoke ammunition. Therefore, the use of ammunition must be increased by 40% for it to have the same effect as during the rest of the year when there is no snow.

If there is a lot of snow, falling snow or wind, the combat distance will decrease as visibility decreases.

Sound from combat vehicles, for example, is deadened by snow and wind and it can be very difficult to hear vehicles approaching. On the other hand, in cold and clear weather the sound of a vehicle travels for many kilometres.

Preparations

Weapons

Check that your weapon is in good working order. If it is below -20°C, the weapon and its magazine must be dried if you are not using CLP.

A completely frozen weapon can, in an emergency, be thawed out with the help of 'Alcohol 35'.

Ask your commander for permission to test fire hand weapons and machine guns.

Checklist for Small Arms and Machine Guns

- Unload the weapon and remove the magasin.
- Repeatedly move the mechanism to check that it works smoothly.
- Check that the safety catch functions and test fire the weapon.
- Check that the sights are complete, correctly installed and free from snow and ice.
- Check that the flash eliminator is tight, the muzzle cover is on and the safety bottom hatch on machine gun 58 is closed.
- Check that the magazine spring mechanism is not frozen.
- Check that the feeding mechanism and the belts on the machine gun 58 are not frozen.
- Set the gas pressure at a higher position than usual. Reduce it gradually until the weapon is warm.
- On assault rifle ak 5 the gas pressure knob should initially be in position 2 (the knob to the right).

Checklist for Anti-tank Weapons and Anti-tank Guns

Make sure that the weapon is not loaded before servicing.

- Move the trigger back and forth several times.
- Check that the striker works.
- While in firing position adjust the bore sights and open aiming devices so that they become acclamatised. CAUTION! It is the temperature of the gun powder *not* the outside temperature that matters!
- Make sure that snow does not enter the barrel. For example, put a thin plastic bag over the muzzle and the breechblock. Attach the bag with plastic bands or string.

Aiming Devices and Sights

Usually, mechanised units do not need to carry out temperature adjustments on aiming devices or sights. It is the temperature of the gunpowder that matters. If the ammunition is brought from heated storage in a combat vehicle, for example, the adjustments should not take place until the ammunition has reached the outside temperature. It can take an hour or so for the ammunition to adjust.

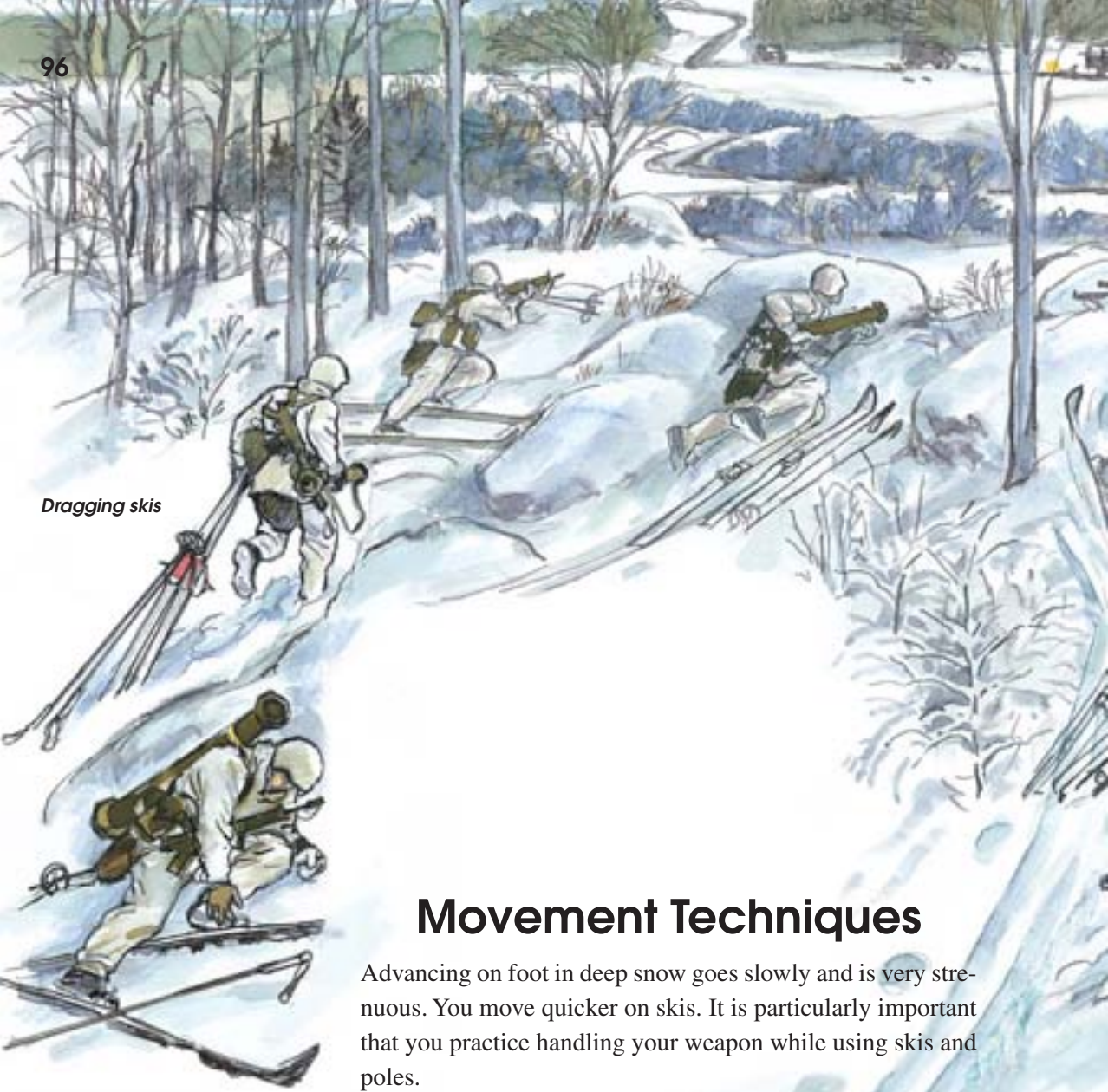
The aiming devices on the Carl Gustav anti-tank weapon and other optical aids fog up when they are brought out into the cold. Instead, use the open sights.

Use open sights!

Prepare your firing hand. Put on your five-fingered gloves. Put your mittens in the pocket of your jacket.

Personal Equipment

- Adjust your clothing. Dress so that you feel somewhat cold before you start moving.
- When it is very cold, the commander decides if thermal jackets will be needed. Put it in your combat pack or roll it up on your back.
- If you are wearing a fragmentation vest, make sure that it is adjusted and done up.
- Check that the skis do not have ice build-up on their gliding surface and that the bindings are complete.



Dragging skis

If you are under fire, take cover by throwing yourself down in the snow with the skis to the right (for right-handed people) or slightly apart. Then take off your skis and leave them and continue combat on foot.

Movement Techniques

Advancing on foot in deep snow goes slowly and is very strenuous. You move quicker on skis. It is particularly important that you practice handling your weapon while using skis and poles.

If the *snow is over 50 cm deep*, you will normally advance *on skis*. This is especially true if the snow is good for skiing, the terrain flat or slopes downward, good skiing skills prevail in the unit and the estimated travelling distance is great.

The more the snow depth increases above 50 cm, skiing will become proportionally quicker than advancing on foot.

If the *snow is less than 50 cm deep*, advancing *on foot* is the norm. This is particularly true if the snow is bad for skiing, the terrain is hilly or broken up by artillery fire, skiing skills in the unit are weak and the travelling distance is short.

Crawling with skis

If the *frozen crust* of the snow is hard enough, advancing on foot is the norm. Removed skis may, if the distance is short, be brought along either by 'dragging' or 'crawling with skis'.

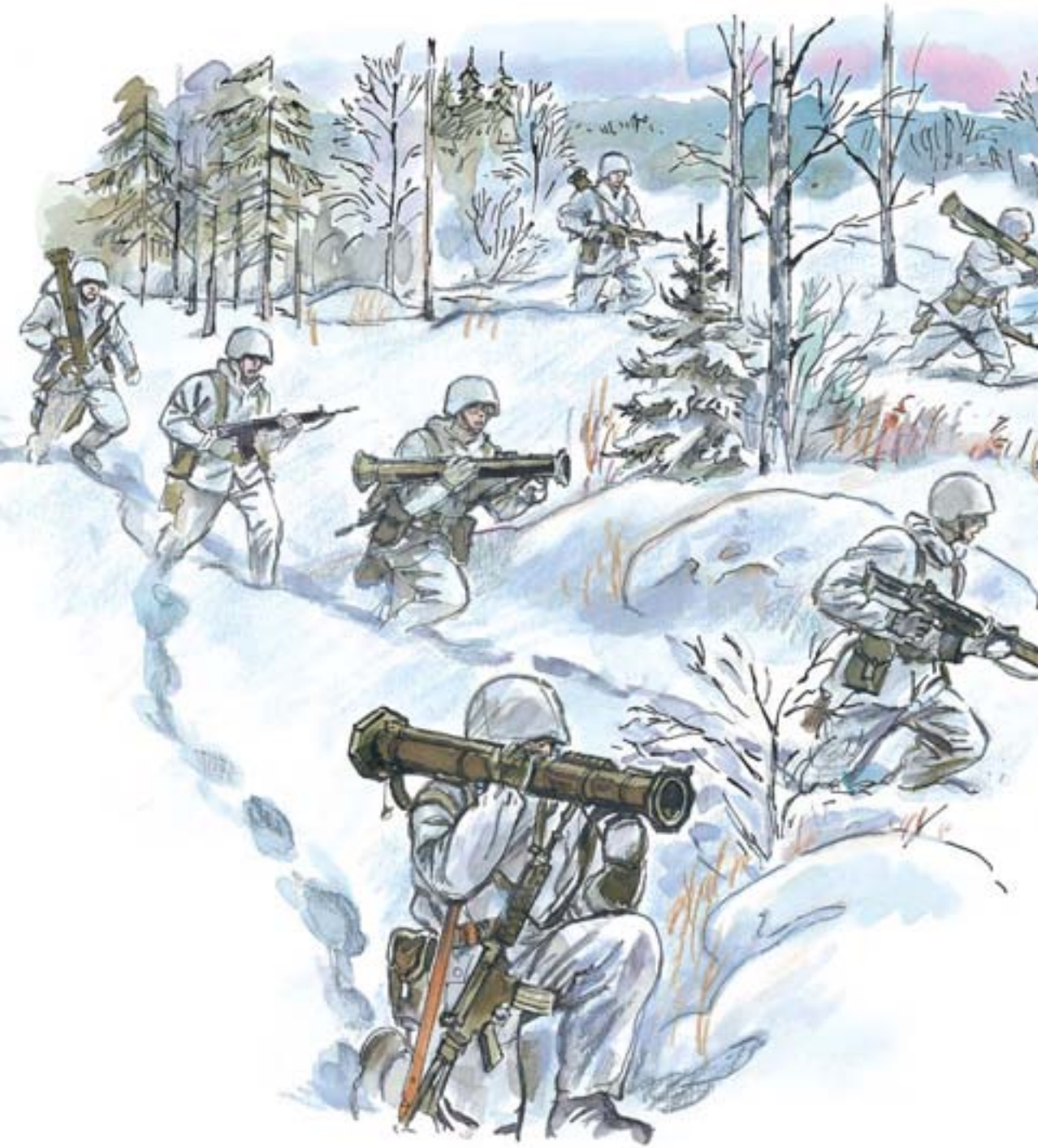
When *dragging*, the poles are pulled through the toe straps from the front. The skis are held with one hand by the tips while the other hand carries the weapon. The weapon may be slung across your chest.

When *crawling*, the poles are pulled through the toe straps from the front. Crawl between the skis with your hands on the toe straps and your lower arms resting on the skis. The weapon is slung across your chest or your back.

The commander will decide if the advance shall take place on foot or on skis.

CAUTION!

Combat on skis must be avoided, but it may take place if there is surprise encounter with the enemy.



Combat Tracking

Often troops must advance quickly. If you are at the head of a column, you make a track either by running or skiing for as long as you can manage. Often a soldier is not able to continue for more than ten meter in deep powdery snow or in bad skiing conditions. Move to the side ready to open fire until the next track maker moves to the side. You then join the rear of the column.

Firing Readiness

How you carry your weapon depends on the tasks you have, the equipment you are carrying and the chances of you encountering the enemy.

If you are expecting combat while skiing, your weapon should be hung around your neck. An ak 5 should be carried butt unfolded. If you are an anti-tank weapon marksman you should carry your small arms on your back. For very short distances you can ski carrying your weapon in one hand and the two poles in the other. The poles should be threaded into each other.

Combat team with high firing readiness.

Different ways of carrying a weapon while skiing.

Both anti-tank weapons and ammunition can be attached to the frame of a rucksack.

Firing Points and Firing Positions

When the snow is deeper than 30 cm, it is difficult to fire from a prone position because elbows and weapons sink into the snow. If you have not got the time to prepare a firing position with support for the weapon, it is best to kneel.

The chances of hitting a target accurately increase if you use a support, for example, a tree. However, look out for the snow from its branches falling on you and your weapon. This may happen if you push the tree or when you fire a light or medium anti-tank weapon.

When driving a combat vehicle, pay attention to snow-laden trees when choosing a firing point. For a while, the snow from the trees can make it impossible to use the sight and prismatic binoculars. Another problem is that once the snow has fallen off the tree, your firing point is exposed.

When the snow is deeper than 50 cm, it requires considerable preparations and takes a long time to arrange firing points for the *missile systems*, anti-tank guided missile 56 and surface-to-air missile 70. A hole must be dug for the launcher and the snow must be removed from a large area around the missile launcher. Otherwise, the firing of the missile will cause such a 'snowstorm' that the soldier will lose eye contact with it. Anti-tank guided missiles 56 are best grouped on top of Armoured Personnel Carrier 401 or on a snowmobile sled.

To improve aim, *machine gun 58*, *automatic rifle 90* and *sniper gun 90* should be fired from a prone position using a weapon support. To stop the weapon from sinking into the snow use a snow support, sled or rucksack.

Automatic rifle 90 in firing position using a sled as support.

Mechanised Unit

Units equiped with *Shrapnel proof vehicles* (for example, Armoured Personnel Carrier 401) or *combat vehicles* (for example, APC 302 and combat vehicle 90) advance as far as possible, troop mounted. The vehicles drive in combat formation with closed hatches and get as close to the friendly artillery fire they can. The vehicles then proceed as fast as possible until they reach firing positions, from where they will engage the enemy.

Generally, *units using APC 401* unload the soldiers in the combat position area to engage the enemy with their own weapons. When the snow is very deep, the soldiers take up firing positions in the tracks left by the vehicle after it has driven in an arc. The APC remain in combat position next to the group. The machine gun mounted on the vehicle is used to fight enemy foot soldiers and the APC provide cover from enemy fire.

The commander of an APC 401 unit decides whether the unit will advance on foot, by ski or mounted.

Keep the ski bindings in the pocket of your snow jacket. The sections skis are divided into two groups and strapped to each side of the vehicle, which allows for easy access.

Units using combat vehicles do not usually unload when the snow is deeper than 50 cm. Firing takes place using the vehicle's weapon, while the soldiers fire through the hatches. This is known as vehicular combat.

Caring for the Injured

In winter it is especially important that injured soldiers are cared for quickly. Hypothermia sets in quickly for two reasons: loss of heat from lying in the snow and reduced circulation caused by the injury. Bleeding must be stopped immediately because it is very difficult, even impossible, to insert an intravenous drip at temperatures below freezing point.

During combat, medics should carry a medical kit, a canvas stretcher and a blanket.

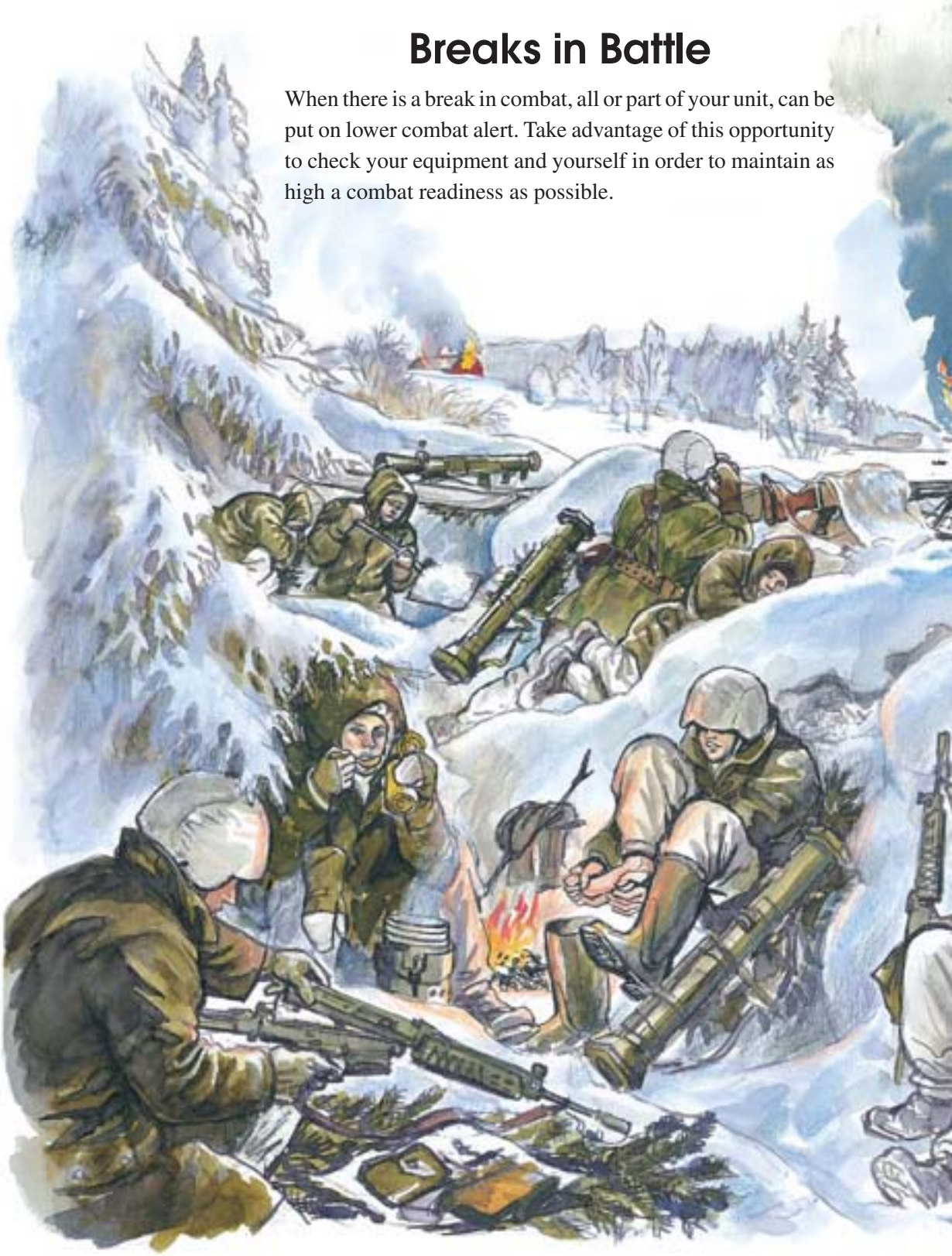
A sled that is used as a casualty transport must be insulated with spruce branches or ground sheets.

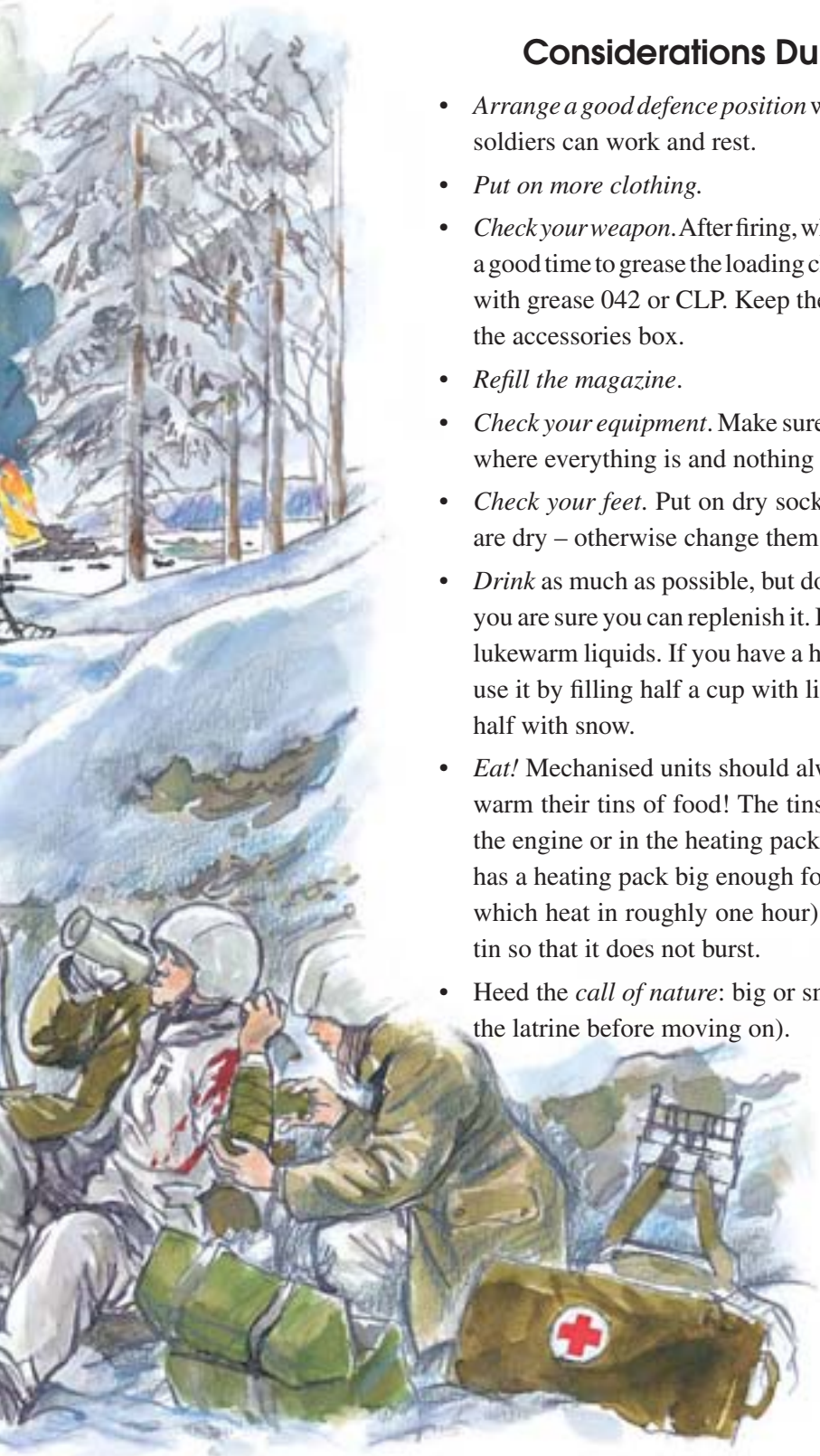
For short distances, the canvas stretcher can be used to pull an injured soldier to cover or to a MEDEVAC point.

First, place the blanket on the sled, then place the injured soldier on the blanket, tucking him in well. If it is very cold and there is a long way to go, the blanket must be reinforced by one or more thermal jackets.

Breaks in Battle

When there is a break in combat, all or part of your unit, can be put on lower combat alert. Take advantage of this opportunity to check your equipment and yourself in order to maintain as high a combat readiness as possible.



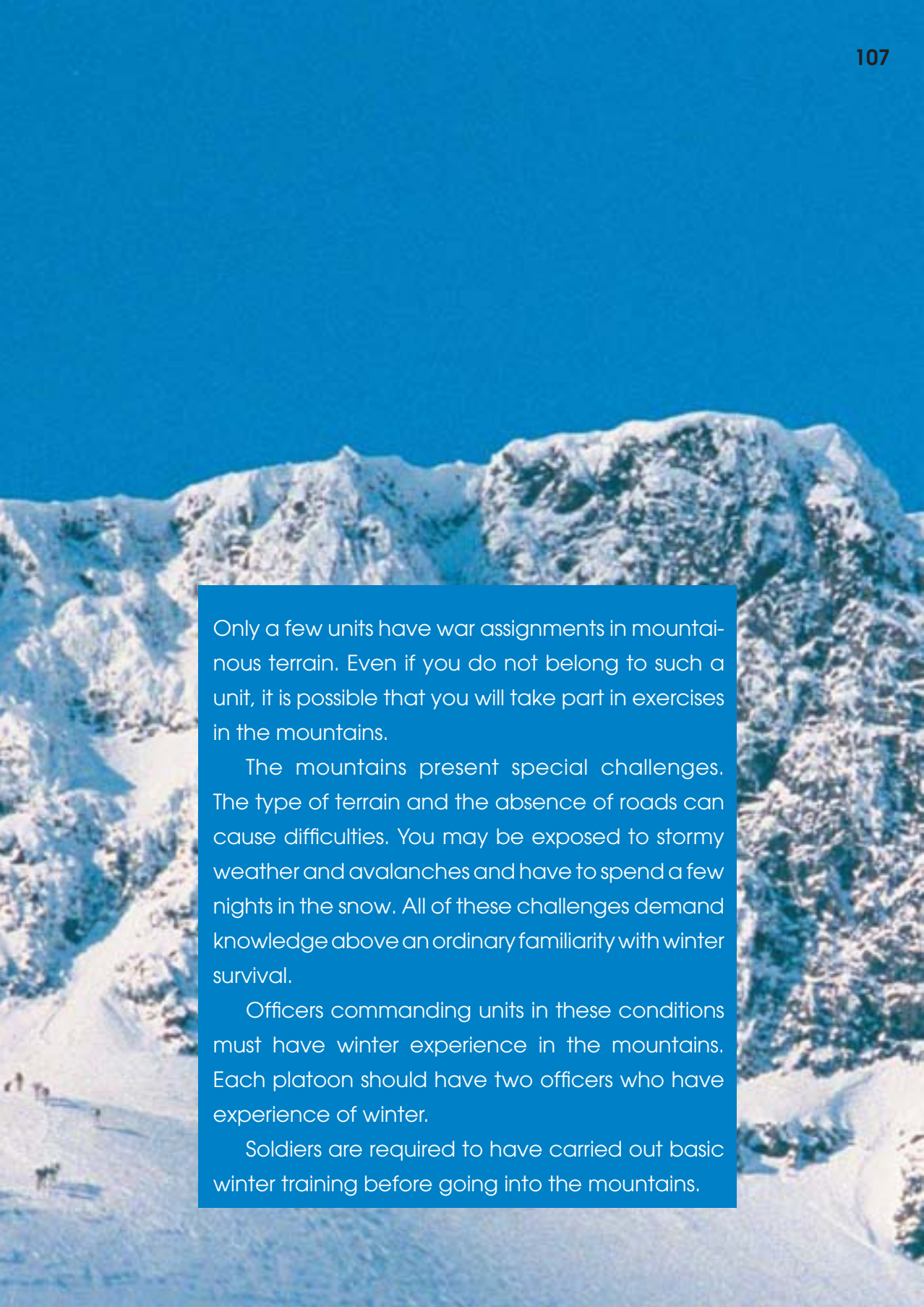


Considerations During Breaks

- *Arrange a good defence position* where you and your fellow soldiers can work and rest.
- *Put on more clothing.*
- *Check your weapon.* After firing, when the weapon is warm, is a good time to grease the loading chamber's sliding surfaces with grease 042 or CLP. Keep the oil in a compartment in the accessories box.
- *Refill the magazine.*
- *Check your equipment.* Make sure it is complete, you know where everything is and nothing is missing.
- *Check your feet.* Put on dry socks. Make sure the insoles are dry – otherwise change them.
- *Drink* as much as possible, but do not drink all of it unless you are sure you can replenish it. If possible, drink warm or lukewarm liquids. If you have a hot drink in your thermos, use it by filling half a cup with liquid and fill up the other half with snow.
- *Eat!* Mechanised units should always make sure that they warm their tins of food! The tins can be warmed up near the engine or in the heating pack (the tracked vehicle 206 has a heating pack big enough for 10 tins (300 g each), which heat in roughly one hour). Make a tiny hole in the tin so that it does not burst.
- Heed the *call of nature*: big or small. (Make sure you use the latrine before moving on).

MOUNTAINOUS TERRAIN

Equipment	108
Map Reading in the Mountains	110
Stormy Weather and Poor Visibility	111
Bivouacking	117
Injuries and Accidents in the Mountains	123
Avalanches	127



Only a few units have war assignments in mountainous terrain. Even if you do not belong to such a unit, it is possible that you will take part in exercises in the mountains.

The mountains present special challenges. The type of terrain and the absence of roads can cause difficulties. You may be exposed to stormy weather and avalanches and have to spend a few nights in the snow. All of these challenges demand knowledge above an ordinary familiarity with winter survival.

Officers commanding units in these conditions must have winter experience in the mountains. Each platoon should have two officers who have experience of winter.

Soldiers are required to have carried out basic winter training before going into the mountains.

Equipment

In addition to standard equipment, the following items are required for units carrying out winter exercises in the mountains:

Safety line

One per soldier. The cord must be coloured, made of nylon, 10 m long and 4 mm thick. It should be kept tied to the pocket of the snow jacket.

Caution! It must not be cut.

- Must be unwound when passing through avalanche prone areas.
- Used to make a rope team in stormy weather.
- Used as a connecting cord between snow bivouacs.

Goggles

One pair per soldier.

- Eye protection during stormy weather.
- Protects against the glare of the sun (see Injuries and Accidents in the Mountains).

Cords

A few metres per soldier. Keep easily accessible.

- Used as a safety lanyard for skis to avoid losing them in steep terrain.
- Provides ‘grip’ when ski marching uphill in difficult conditions. Wrap the cord a couple of times around the skis just behind the toeplates.

Spare Ski Tips

A pair per group.

Spare Ski Bindings

A pair per group.

Candles

Two per soldier.

- Used as a light source in snow or emergency bivouacs.
- Used as gliding wax for skis.

Infantry Spade with Snow Shovel Attachment

One per soldier.

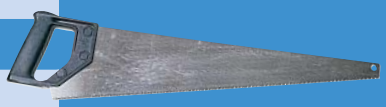
- Used for digging in the snow.
- Used as a pitch-axe.

Sled

One per group.

- Transportation of equipment.
- Transportation of the injured.

Saws



Two per group.

- Used to saw or cut out blocks of snow (lee walls, snow bivouacs).
- Used to saw wood.

Snow Shovel

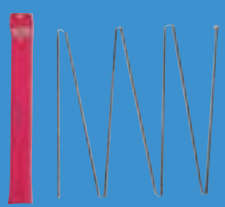
Two per group. A snow shovel has a larger capacity than an infantry spade.

Wind protection sack

3–4 soldiers per wind protection sack.

- Used as a windbreak in stormy weather.
- Used as an emergency bivouac.
- Used as a door to snow bivouac.

Avalanche Probes



1–2 per platoon.

- Used to check snow depth (for example, when snow bivouacing).
- Used to search for victims of an avalanche.

Always provide your commander with all alternative march routes and ETA.

Map Reading in the Mountains

Most mountain maps are on the scale of 1:100,000 and in Sweden they cover the area from northern Lappland to Dalarna. For certain areas there are maps on a scale of 1:50,000. The distance between contour intervals is normally 10–20 metres.

When Visibility Is Good

When the weather is good, surveying in alpine terrain is completely different than in wooded terrain and often the whole route is visible from one position. This grand terrain makes map reading easier because prominent ridges, mountaintops and valleys can been seen clearly. Advances take place along valley bottoms.

Choosing a route is a matter of 'reading' the terrain and selecting the most energy-saving path. This is done by following the contour lines in order to 'maintain altitude', when possible, even if it means the distance will be considerably longer.

When Visibility Is Poor

In stormy weather or when the visibility is limited or poor, good judgement is required for troop movements. If it is necessary to advance and the unit cannot wait until conditions improve, it is important to choose a route that avoids sudden dangers such as ravines and precipices. When advancing, it is important to read the compass carefully and to 'pace' (count the number of pole markings per 100 metres). The compass bearing must be checked often so that the route is followed. To make the advance easier, strive to use 'handrails', such as marked routes, telephone poles or fences. The reading, marking and pacing of the terrain should be done continuously so that you always know where you are.

Winter Routes

Winter routes are marked by poles that have crosses at the top. The poles are between 2.5–3 m high so that they are visible even in very deep snow. In hollows, for example, deep snow can sometimes cover the whole pole. In order to find the route again, tie a safety line to the nearest visible pole and search for the route.

There are many requirements for marking and planning winter routes. Winter routes are like handrails to 'hold onto' when it is dark and stormy. The markings (pole crosses) have been designed and placed so they are easy to find and follow. The distance between the markings will never be more than 40 m. Normally, winter routes are straight and run across moors and bogs in terrain that is not avalanche prone.

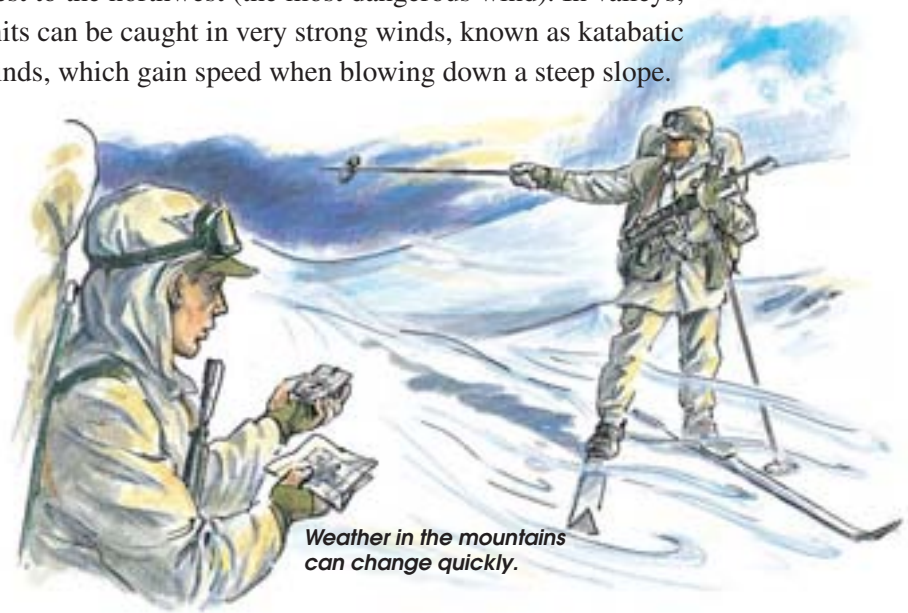
Two crosses on top of a single pole are used at an intersection or to indicate a change in a route's direction.

Stormy Weather and Poor Visibility

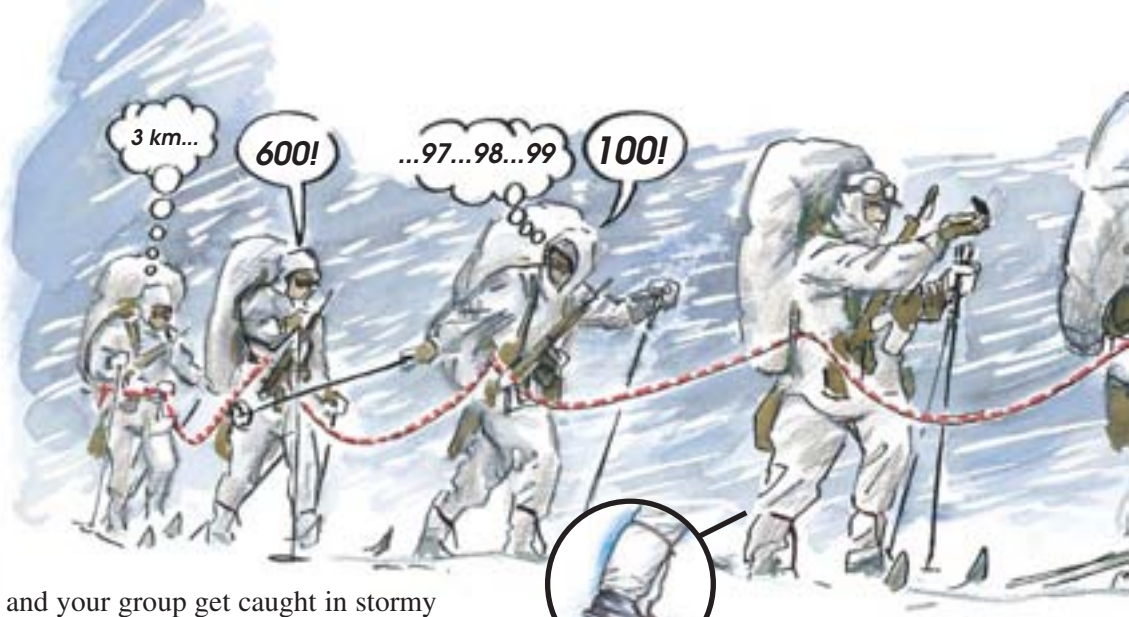
CAUTION!

Always carry a map and a compass when in the mountains.

Weather in the mountains can change quickly. Strong winds can begin suddenly. Signs of approaching bad weather might include an increase in cloud cover, an increase in wind speed and a change in its direction – generally, from the south or southwest to the northwest (the most dangerous wind). In valleys, units can be caught in very strong winds, known as katabatic winds, which gain speed when blowing down a steep slope.



Weather in the mountains can change quickly.



Use a string as a safety lanyard for the skis.

If you and your group get caught in stormy weather above the tree line, take cover quickly. There are three alternatives:

- Move down to the tree line where it is easier to find protection from the wind.
- Turn back – if that is the shortest route. Take into consideration that it can be much more difficult to make your way through strong wind and drifting snow.
- Find a suitable place to dig an emergency bivouac quickly.

Considerations when Marching in Poor Visibility

- *Keep the group together.* In foggy or stormy weather it may be necessary to rope up the group using a safety line. The line must be tied around the first man and then threaded through the other soldiers' rucksack frames or combat harnesses until finally being tied around the last man. If this is not done, there is a risk that advancing will be jerky.
- *Keep an eye on your equipment!* In stormy weather a glove or cap will disappear quickly if you are careless.
- *Remain calm.* Everyone in the group is to be given a task. One person needs to be assigned for each of the following: tracking, checking the compass bearing, counting paces or pole markings, counting off each 100 metres and counting off the kilometres.
- *Use the compass* and trust it. Immediately take a compass bearing before the visibility becomes too bad. Direct the compass towards a suitable point of orientation before it disappears from view.
- *Look out for brooks at the bottom of ravines.* It is easy to fall into a ravine and the ice on the brook is often very thin.
- *Travel with the wind (at your back) if possible.* To reach cover, it can be better and safer to choose a long route with the wind at your back than a short route facing the wind. If visibility is nil and you to have to travel facing the wind, and if snow conditions permit, it is easier and saves energy to walk using ski poles for balance and support.

The Wind's Effect on People and Snow	
Wind	**Effect**
8–11 m/s *Brisk breeze*	*Difficult to walk against the wind. Driving snow whips against the face. Usually, snowdrifts are low; however, they can be more than standing height.*
12–14 m/s *Strong breeze*	*Very difficult to walk against the wind. Loose blowing snow may cause standing height snowdrifts. Difficult skiing; low, dense snowdrifts obscure terrain features.*
15–17 m/s *Near Gale*	*Difficult skiing; low, dense snowdrifts obscure terrain features. Considered to be a 'storm' by most skiers. High drifts reduce visibility to a few hundred metres at most. It is difficult for group to keep together.*
18–21 m/s *Gale*	*Impossible to orientate yourself. Visibility is extremely poor. Difficult to follow marked routes. Difficult to ski even when travelling with the wind. It is difficult to use ski poles.*
22–24 m/s *Strong Gale*	*Wind and blowing snow make it impossible to use skis on the mountain. It is very difficult to walk even with the wind. Visibility is nil.*
25–32 m/s *Storm*	*Find shelter immediately, either indoors or under the surface of the snow.*
33 m/s *Violent Storm*	----------

- *Avoid uneven terrain.* Visibility is often so poor that unevenness is not noticed in time. Obstacles that are not normally a problem can cause serious injuries. It can be safer to proceed on foot over very uneven or broken ground.
- *During mounted marches* in stormy weather and zero visibility, it is necessary for one person to walk or ski in front of the vehicle so that it does not tip over or drive into a ravine. The soldier in front should be roped to the vehicle. If there is a compass in the vehicle, it should be used. The blinking indicators or other forms of signals from the vehicle can guide the soldier. If the vehicle does not have a compass, then the soldier in front must maintain the bearings. Do not forget to read the trip mileage counter.

During a mounted march in zero visibility, it will be necessary for a soldier to walk or ski in front of a vehicle.

Example of a snow wall.

Do not put skis in the snow! They can be broken by strong wind or be blown away. Lay the skis down and connect them by slipping the ski poles through the bindings.

Taking a Break during Stormy Weather

WARNING!

Never sit or lie in the snow to rest without first making a windbreaker and laying down insulation.

When taking break during bad weather:

1. Build a windbreaker of snow or put up a wind protection sack.
2. Add layers of clothing.
3. Drink warm liquids.
4. Check each other for white marks on the skin and physical fitness.
5. Decide how to proceed (route, tasks) or if an emergency bivouac needs to be built.

WARNING!

In stormy weather build a windbreaker without using skis, otherwise there is a risk that the skis will rip the wind protection sack.

Emergency Bivouac

If the group encounters stormy weather and it cannot move or is too tired to continue to a sheltered area below the tree line, then the commander must decide whether or not to order a bivouac. The decision must be taken while the group has enough strength to find a suitable place and to dig a shelter!

An emergency bivouac protects against the wind and the cold. In the shelter the group can rest, eat, drink and wait for better weather. Choose the type of bivouac construction based on the snow in the area.

The bivouac needs to be built quickly. Use skis, poles and wind protection sack as building material.

Two types of bivouacs are described below: emergency snow caves and emergency snow holes.

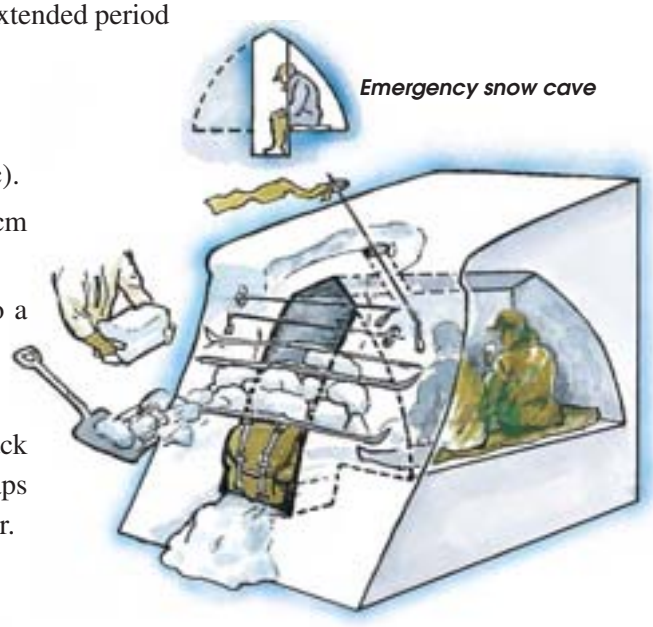
The Emergency Snow Cave

An emergency snow cave presupposes that there is a snowdrift, for example, in a ravine. This is the best emergency bivouac because

- It requires the same digging techniques as a snow bivouac.
- There will be protection within 20–30 minutes.
- When necessary, it may be expanded if bad weather forces the soldiers to remain there for an extended period of time.

Proceed as follows:

1. Dig an entrance (see Snow Bivouac).
2. Dig straight into the drift, approx. 70 cm per person.
3. Carve one side (or both sides) into a bench.
4. Move in.
5. Put skis, poles and wind protection sack across the entrance and fill in the gaps with snow. Use a rucksack as a door.



Emergency snow cave

Emergency Snow Hole

Use an emergency snow hole when there are no snowdrifts. The snow needs to be 1.5 m deep in order to build an emergency snow hole; check the snow depth with a probe or pole.

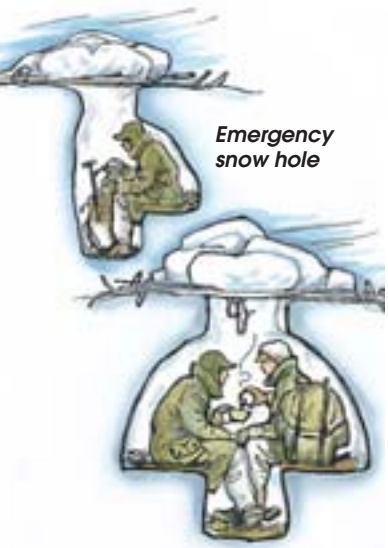
Proceed as follows:

1. Dig a ditch about 70 cm wide and approx. 1m per person in length.
2. Carve out approx. 1 m on both sides once the hole is deep enough.
3. Use skis and poles as beams across the ditch and cover with a wind protection sack.
4. Cover with blocks of snow. Use a rucksack as a door.

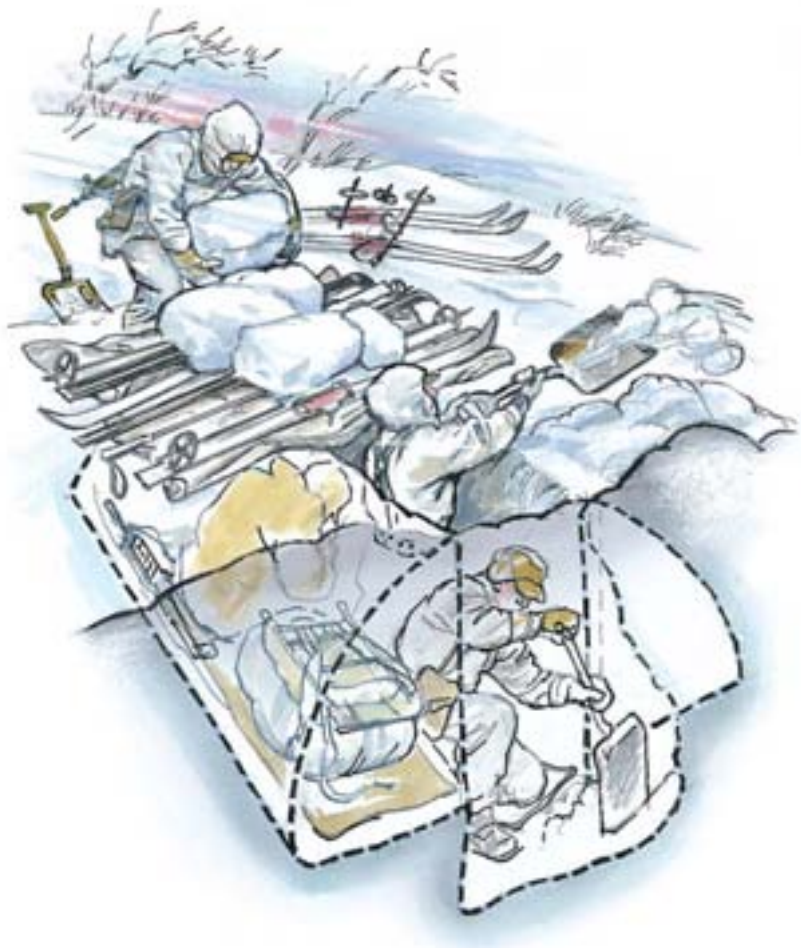
WARNING!

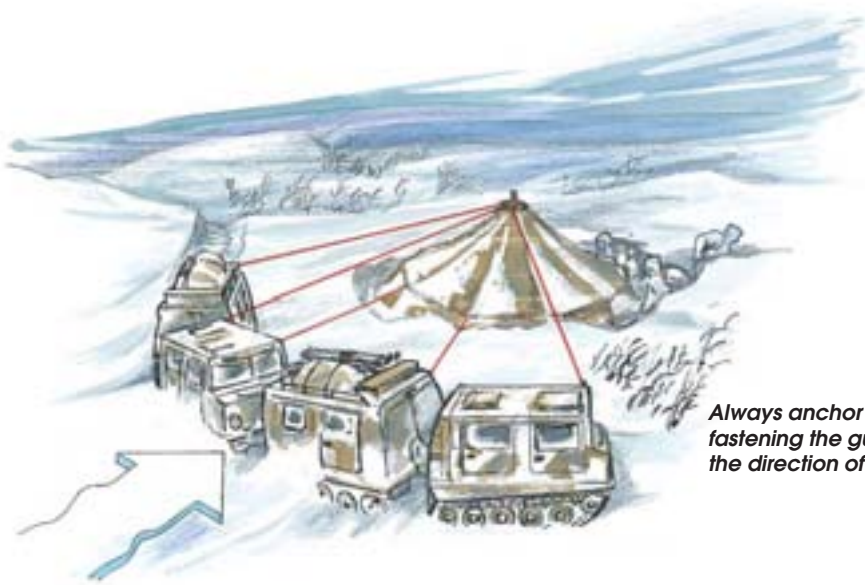
Cooking in an emergency bivouac may only take place if sufficient ventilation can be guaranteed, for example, in an open entranceway.

See Carbon Monoxide Poisoning (p.124)



Emergency snow hole





Always anchor the tent by fastening the guy ropes in the direction of the wind.

Bivouacking

Units working in the mountains often have vehicles (tracked vehicles or snowmobiles), which carry ordinary bivouacking equipment. Make sure that enough firewood is included.

Tents

The bivouac site should be chosen in the woods below the tree line. It is easier to find shelter against both wind and detection there than on the bare face of the mountain. It is also easier to find firewood.

In intense cold, the bivouac should not be made in a hollow because the cold air is heavy and remains in low places.

If forced to bivouac on the face of the mountain, choose a site where the snow depth allows the tents to be slightly dug in for protection against the wind.

Anchor the tents properly. If there are no snow pegs (40-60 cm long wooden pegs), then use ski poles instead.

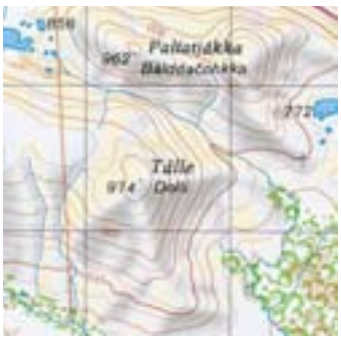
Secure the tent by anchoring the guy lines in the direction of the wind. Attach the lines to the tent before raising it.

Snow Bivouac

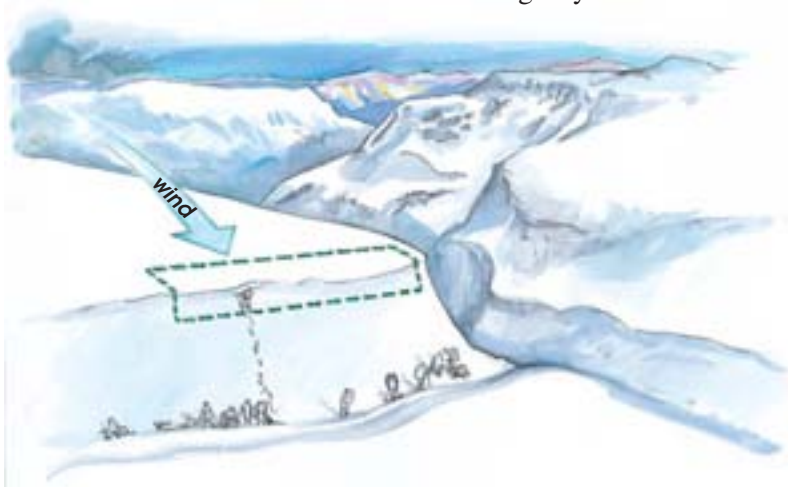
A snow bivouac is for temporary use by smaller units. A well-built snow bivouac can replace tents or billets for a few days.

With the help of a map and by studying the terrain, it is easy to find a suitable place to bivouac. Often large amounts of snow have drifted into small ravines, behind small hills and at the bottom of hollows. The snow is blown to the leeward side where it collects and is easy to dig out.

There are many models of snow bivouacs and there are several ways to build them. Only the snow cave, which can be dug in both good and bad weather, will be described here. The same method is used to build an emergency snow cave.



A suitable place to build a snow bivouac is in a ravine in a lee. Study the map!



The most important thing when snow bivouacking is to avoid getting wet because the opportunity to dry wet clothes is practically nil. Avoid touching the snow with anything other than a 'shoe and a shovel' and avoid sweating by adjusting your clothing and your work pace. Brush snow from equipment and clothes.

Snow Cave ('snöka')

A cave is built in a snowdrift that has a distinct edge and is at least 4 m deep (the length of a probe). It will take about 2 hours for experienced soldiers to complete a snow bivouac in good weather conditions. It may take inexperienced soldiers 8–10 hours to build one!

A maximum of 2–3 men should stay in the same 'snöka'. This way all of them can contribute to its construction. One person will dig, one person will remove the snow (8–10 m^3) and one person will act as a stand-by to supply the diggers with food and drink.

Proceed as follows:

1. Make sure the snowdrift is not *avalanche prone* (see p. 127).
2. Climb as *high up on the drift* as you can. Try to see over the top. There are two reasons to dig this high:
   - If there is blowing snow during the night (several metres of snow may pile up in drifts covering the entrance),you must be able to get out by digging upwards.
   - All the snow (8–10 m^3) that is removed must be able to fall away from the entrance.
3. *Probe the snow depth*. If many bivouacs are to be built in the same drift, it is important that they are built at the same height. The gap between two entrances must be approx. 4 m (the length of a probe).
4. *Adjust clothing* for hard work! Take off as much clothing as possible. Avoid touching the snow.
5. *Remove the overhang* and the loose snow.
6. *Dig an entrance* at least 70 cm wide and high enough to stand up in. This provides enough space to work in without touching the snow and getting wet. The first digs should carve out an inverted 'V' to mark the V-shape of the roof.
7. The entrance should be 2.5–3.5 m deep. Extend the sides gradually to increase working space and do not touch the walls. Keep the V-form in mind to keep the roof strong and to avoid removing too much snow. The walls and the roof must be 20 cm thick to be strong enough and to insulate against the cold.

Probing snow depth.

An entrance way.

CAUTION!

Never walk across the top of a snow bivouac because there is a danger of falling through the roof.

Making a snow block.

Freezing the snow blocks.

8. When the sides are carved out at chest height, *cut out blocks* from the sleeping benches area. Use a saw to cut 150x20x40 cm blocks. This size is perfect for two men to handle. Store the blocks outside the 'snöka' until the entrance is ready to be closed. It will take 4 or 5 blocks to fill in the hole.
9. *Complete the sleeping benches*, which should measure 1x2 m. Each bench should be low enough so that the feet of a person sitting on it touch the floor. Bevel the sides of the platforms so that your calves do not come in contact with the snow.
10. *Smooth* the walls, ceiling and floor. Water will drip from any area, but it will run down a smooth wall and not drip onto clothing and equipment. Use a saw to even out the walls and the ceiling. Make sure that the floor slopes towards the entrance to make it easy for cold air to 'flow' out.
11. *Make two ventilation shafts*, one on each side of the entrance. Make the shafts straight up so that they do not become covered with snow. The easiest way to make a shaft is with a ski pole. Leave the pole in the shaft so that the shaft can be cleared if it snows. The shaft should be

Emergency exit through the roof after heavy overnight snowfall.

about 10 cm in diameter. Make a *candle niche* in the back wall. One candle will light the whole bivouac. Make sure that the candle cannot fall down and set fire to sleeping bags or other gear.

12. If many snow bivouacs are built next to each other at the same height, a '*communication tunnel*' can be dug between them.
13. *Move in* and make sure all equipment, even skis, sleds and shovels, is brought inside so that it is not lost if it snows. The shovels may be needed to dig yourselves out of a bivouac after a heavy snowfall.
14. *Block* the entrance. Plug all holes with snow to stop draughts.
15. The entrance must not be closed until the *commanding officer has given the orders* for next day.
16. *The entrance can be closed* in many ways. A special door block can be made and pulled into place from inside the tunnel using a pole and shovel. The door can be filled in with snow. A rucksack can be placed in the opening or a wind protection sack can be hung over the entrance.

The commander must go from bivouac to bivouac in order to check that everyone is well, that the ventilation shafts and communication tunnels are in order and that cooking is taking place either outside the bivouac or in the open entrance.

Staying in a Snow Bivouac

- Snow not only insulates against cold but also against sound. Since sound from outside cannot be heard inside, it is important that the communication tunnels work and that agreed times are kept.
- There is sufficient oxygen in the bivouac. There is oxygen both in the bivouac and in the surrounding snow. The ventilation shafts let in fresh air and regulate the temperature. The ideal temperature in a bivouac is a few degrees below zero. When the temperature rises above 0°C, drops form on the ceiling and the risk of getting wet increases. Widen the shafts or unblock the entrance to return the temperature to below 0°C.
- Place some birch branches between the groundsheet and the bench to prevent slipping, otherwise you risk sliding off the bench. Do not unroll your sleeping bag before use. 'Fluff up' the sleeping bag to make the filling full of air in order to insulate better. Place a ski, for example, on the bench between the sleeping bag and the wall to protect it from touching the snow and getting wet.
- Brush off all the snow from clothes and footwear.
- Keep a thermos handy so that you can have a warm drink. Keep a thermal jacket easily accessible so that you can put it over you if you are cold during the night.
- Prepare a thermos breakfast and cold food in the evening so that you do not have to get out of your sleeping bag to have breakfast. It is cosier to have 'breakfast in bed' than to go outside in bad weather.
- Be ready to leave on time. Inform the commander that you are ready either via the communication tunnel or by an agreed signal, for example, by placing a ski outside the entrance.
- Remain inside until the order to leave has been given.
- Tidy the bivouac before leaving.
- During bad weather, it may be necessary to use one area of the bivouac as a latrine.

WARNING!

Do not cook food inside a bivouac because there is a risk of carbon monoxide build-up.

Injuries and Accidents in the Mountains

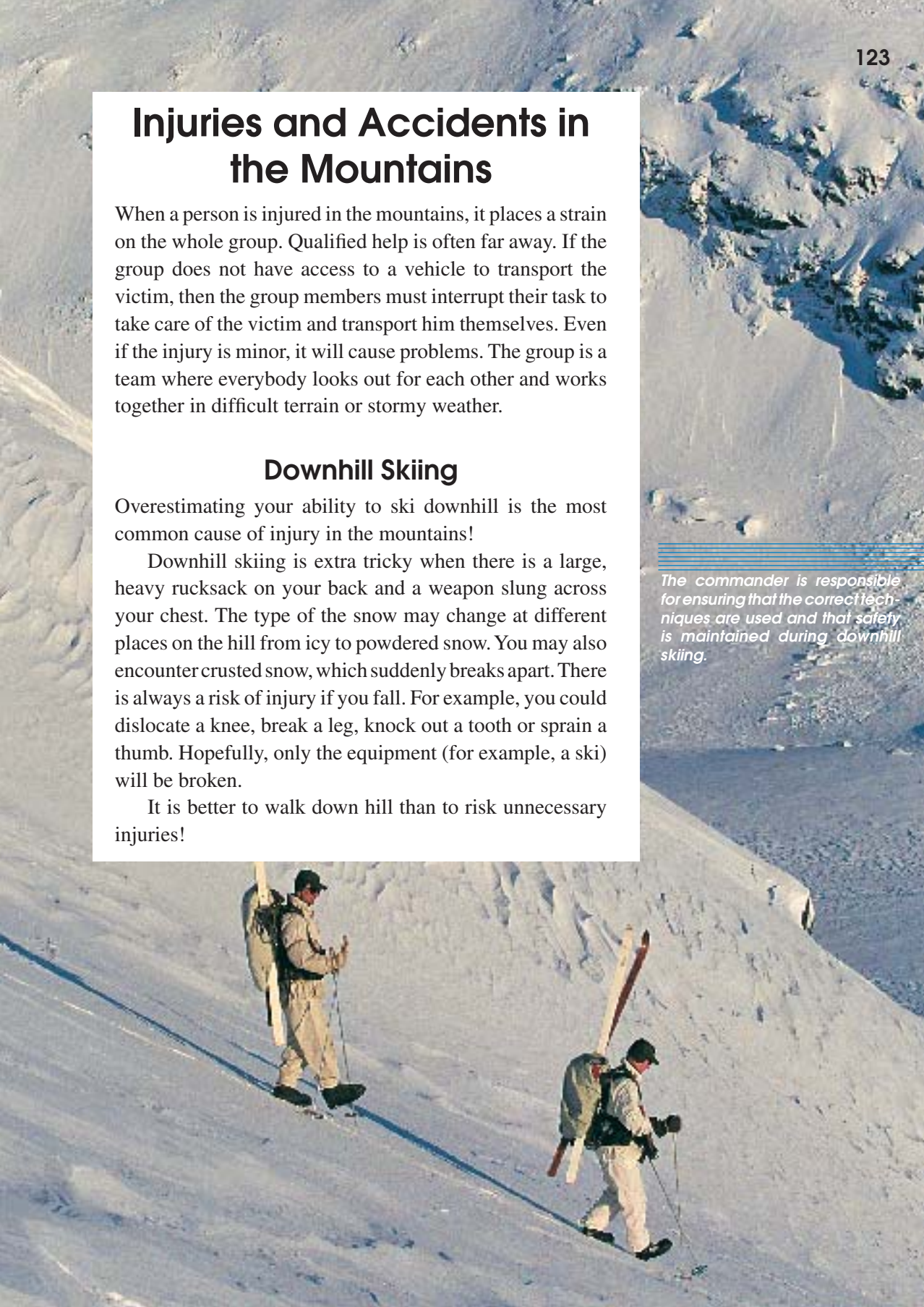
When a person is injured in the mountains, it places a strain on the whole group. Qualified help is often far away. If the group does not have access to a vehicle to transport the victim, then the group members must interrupt their task to take care of the victim and transport him themselves. Even if the injury is minor, it will cause problems. The group is a team where everybody looks out for each other and works together in difficult terrain or stormy weather.

Downhill Skiing

Overestimating your ability to ski downhill is the most common cause of injury in the mountains!

Downhill skiing is extra tricky when there is a large, heavy rucksack on your back and a weapon slung across your chest. The type of the snow may change at different places on the hill from icy to powdered snow. You may also encounter crusted snow, which suddenly breaks apart. There is always a risk of injury if you fall. For example, you could dislocate a knee, break a leg, knock out a tooth or sprain a thumb. Hopefully, only the equipment (for example, a ski) will be broken.

It is better to walk down hill than to risk unnecessary injuries!



The commander is responsible for ensuring that the correct techniques are used and that safety is maintained during downhill skiing.

Carbon Monoxide (CO) Poisoning

Carbon monoxide is a gas that builds up during incomplete combustion irrespective of which type of burner is used. Double the amount carbon monoxide is produced when melting snow on a burner than when heating the same amount of water.

Outside, where the carbon monoxide can be dispersed, there is no danger. However, in enclosed areas, for example, small tents and snow bivouacs, carbon monoxide is dangerous. At first carbon monoxide gas remains close to the floor, but after a while it fills the whole bivouac.

Carbon monoxide prevents oxygen from moving from the lungs into the red blood cells. The body reacts quickly and tries to compensate for this lack of oxygen in the blood by increasing its heart rate. In serious cases of poisoning, the lack of oxygen can lead to unconsciousness or death.

WARNING!

Do not cook food inside a tent or a snow bivouac.

Symptoms

- Rapid pulse rate
- Weakness
- Cold sweats
- Headache

Carbon monoxide can remain in the body for a long time, from a couple of hours to a couple of days.

Treatment

- For mild poisoning – rest and fresh air.
- It is important to not exert yourself (skiing) while symptoms remain.
- More serious cases of carbon monoxide poisoning must be treated at a hospital.

Carbon Dioxide (CO_2) Poisoning

Carbon monoxide (CO) must not be confused with carbon dioxide (CO_2). Carbon dioxide is created during all combustion and can also be found in the air a person exhales. High concentrations of carbon dioxide can build up in confined spaces with poor or non-existent ventilation, for example, in a cramped emergency bivouac containing many people.

You may also be affected by carbon dioxide poisoning if you have to stay in a snow bivouac for many days due to bad weather. The build up of ice on the inner walls of the bivouac prevents the oxygen from the snow entering the chamber. In such cases, scrape away the ice and make sure that the ventilation shafts are working.

Rapid breathing (hyperventilation) is a symptom of carbon dioxide poisoning. The treatment is fresh air.

WARNING!

Make sure there is always sufficient ventilation!

Sunburn

In spring, when the sun is up all day and its rays are reflected at all angles against the snow, the face often becomes burnt. The most affected areas are the nose, lips, ears and sides of the neck. If you do not protect yourself against sunburn, the burns may become so bad that the skin will blister and peel, which will cause great pain.

Prevention and treatment

- Take precautions before going out. Make a 'nose protection' out of paper or a Band-Aid. Attach the nose protection to your sunglasses.
- Do not turn your face to the sun unnecessarily.
- Use the snow jacket's hood and wrap a scarf over your face.
- If there are many days of clear weather in a row, it is advisable to rest during the day and advance at night.

A nose protection.

Snow Blindness

CAUTION!

Always use sunglasses even in cloudy and misty weather.

Snow blindness is a burn injury caused by very strong sunlight. It is the result of the cornea absorbing too much ultra violet light. UV-radiation penetrates clouds and mist. Always wear sunglasses. They should be made especially for use on glaciers, have dark glass and provide protection around the eyes. Ordinary ski goggles with dark glass also work. Bad cases of snow blindness can take up to a week to heal.

Symptoms

- Eyes become red, teary, swollen and ‘gritty’.
- Great pain and blurred vision.
- In severe cases, all vision is lost.

Treatment

- Tape sunglasses so that only a narrow opening remains.
- Use drops or salve to ease the pain.
- Rest and darkness (cover eyes completely).

Avalanches

Humility and respect are important qualities to have when confronted with the powers of nature. An avalanche can contain thousands of tons of snow. When an avalanche starts to move, you will realise that humans are very small. The need for discipline, knowledge and skills are crucial in an avalanche danger zone. There are two main types of avalanches: slab and loose or powder snow avalanches.

Loose snow avalanches often occur on steep slopes where snow has accumulated during heavy snowfalls. They are most common when the temperature is below 0°C, the wind is light and the snow is loose.

Slab avalanches are much more common than loose snow ones. Generally, they form on steep, bare mountain slopes (with more than a 25° angle) where the wind has packed the top layer of snow into large slab areas. Slab avalanches occur after large temperature fluctuations and heavy snowfall. A single skier can trigger an avalanche.

The chance of surviving an avalanche is a race against time. The statistics show that most people who survive avalanches are saved by buddy-rescue within 30 minutes. After 30 minutes, chances of survival are reduced drastically and rescue operations require qualified personnel. Therefore, it is important for the people on site to react quickly and efficiently. You may be part of the rescue team. The victim relies on your skills and quickness to save him.

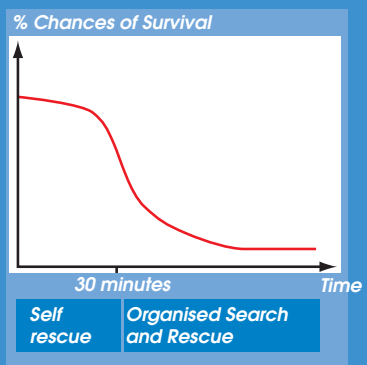
There are examples of people being found alive after being buried in an avalanche for several days. Therefore, there is no reason to give up hope or to stop rescue efforts.

You and your unit should avoid avalanche prone areas when working in alpine terrain. However, the risk of entering a hazard zone remains. Entering a hazard zone accidentally can be caused by bad visibility or incorrect orienteering.

Training and practice in avalanche search and rescue is a must before advancing through or working in avalanche hazard zones.

Powder snow avalanche (200 km/h).

Slab avalanche (150 km/h).



CAUTION!

Approximately 85% of those who survive an avalanche are rescued by their friends.

Avalanche Hazard Areas

1-3 Days of Snowfall (>0°C)	
<30 cm	Small risk
30–50 cm	Risk
50–80 cm	Great risk
>80 cm	Very great risk

CAUTION!

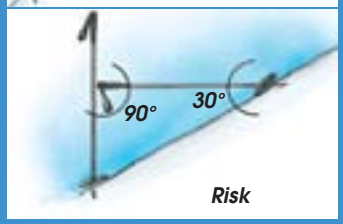
Always respect warning signs and roped-off areas.

It is important to know the following:

- Steep slopes (25°– 45°) with large amounts of loose snow are avalanche prone.
- Temperature fluctuations increase the risk of avalanches.
- Cornices above steep lee slopes and above sharp edges, where the wind has built up large amounts of snow, are clear signs of danger.
- Hollow or 'Whumpf' sounds and cracking and settling are warning signs.
- 1–2 days after a heavy snowfall is when it is it most dangerous.
- Ground conditions play a role in releasing avalanches. The danger is increased if there are no wooded areas, big bushes or large stones to anchor the snow.
- Strong sun and rain loosen the snow. A ball-bearing-like slippery layer is built up when the loosened snow is exposed to temperature variations between night and day. This happens particularly in spring. This increases the danger of slab avalanches especially when there has been heavy overnight snowfall combined with high daytime temperatures. If this happens at the same time as the ground temperature rises, the bottom layer of snow melts and loosens and the risk of a ground avalanche increases. Ground avalanches are very dangerous because they sweep with them all snow, as well as large amounts of stones, earth, gravel and trees.
- Recent avalanches are signs of an avalanche hazard zone. Look for break-off points on the slopes.

Methods for Predicting an Avalanche

The Rutschblock method.



The ski pole method.

The shovel shear test.

Avalanche Hazard Scale and Bulletin

See appendix 1.

Planning

CAUTION!

Ask the locals about nearby avalanche areas.

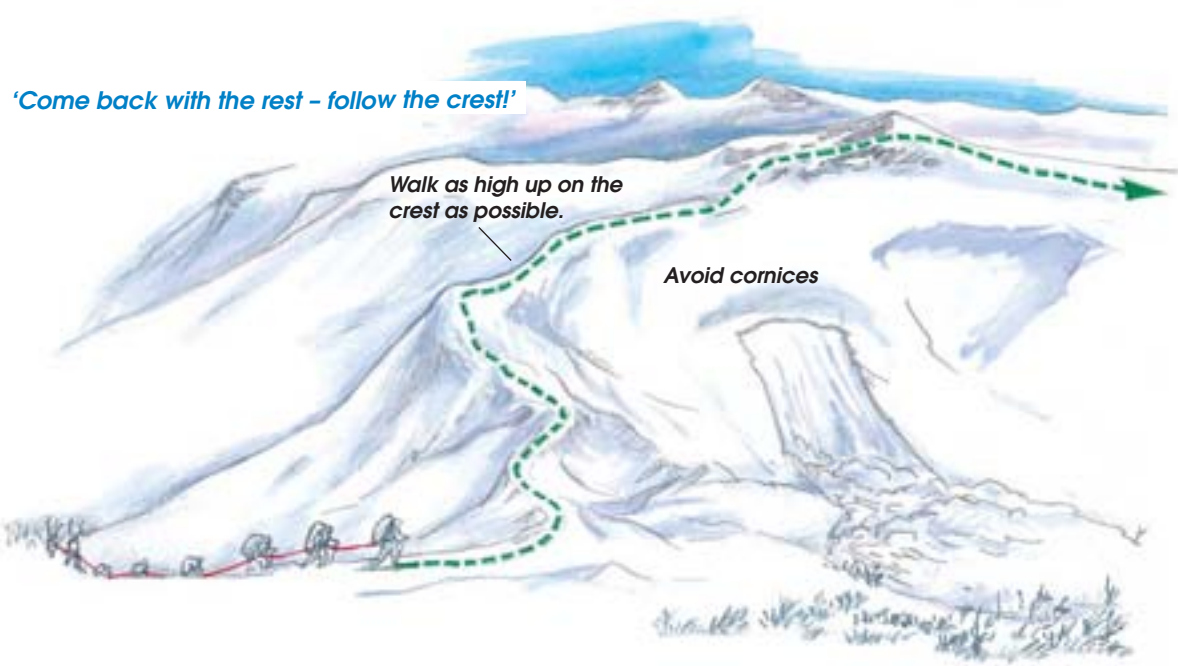
Careful planning before and good judgement during activities in avalanche prone areas are the best ways to avoid accidents.

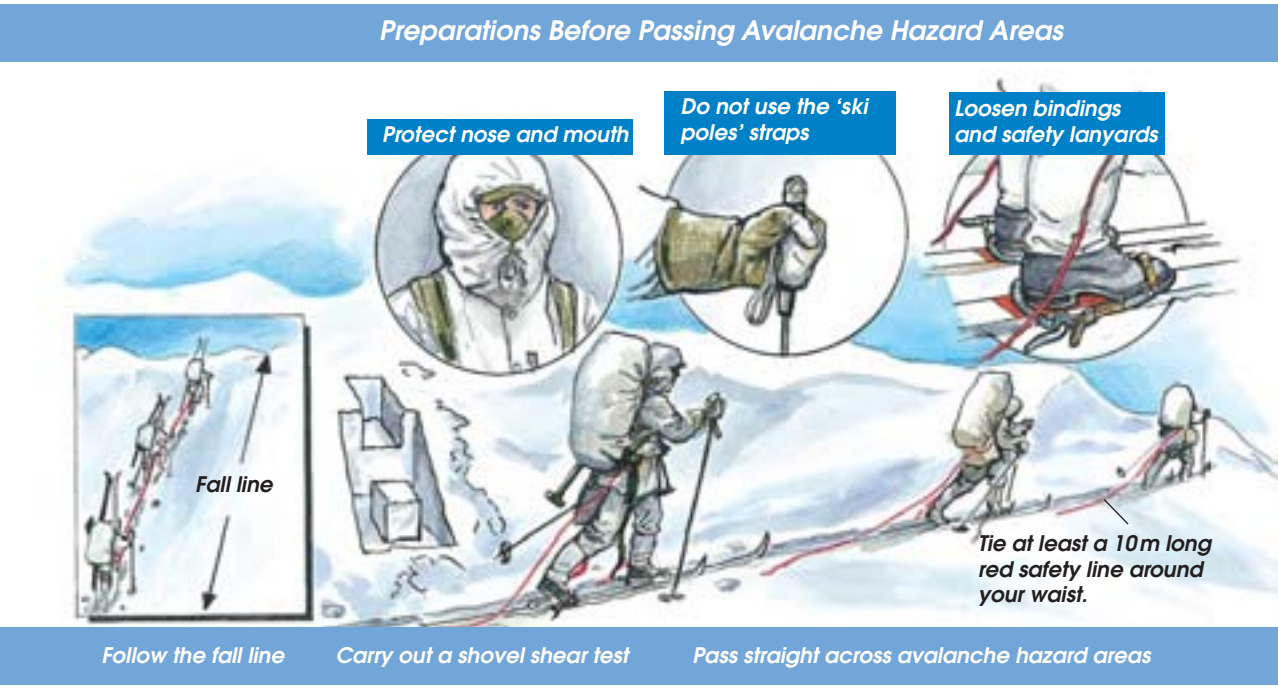
Observe

- Read the map and plan the route.
- Never pass through an avalanche hazard zone unless the commander has assessed it using the Rutschblock method and judged it safe.
- 'Read' the terrain. Flat areas, ridges, bare ground and rocks should be considered relatively safe routes.
- Check and co-operate with local residents, who have knowledge of the area.
- Check the weather over the past few days.
- Get the most recent weather forecast for the area.

CAUTION!

Think first. Later may be too late!




Preparations Before Passing Avalanche Hazard Areas
Protect nose and mouth
Do not use the 'ski poles' straps
Loosen bindings and safety lanyards
Fall line
Tie at least a 10 m long red safety line around your waist.
Follow the fall line
Carry out a shovel shear test
Pass straight across avalanche hazard areas

Traversing an Avalanche Hazard Zone

If you have to pass through an avalanche hazard zone, make sure to:

- *Detail a scouting patrol*. The commander or an appointed instructor is in charge of the patrol.
- Check that the *whole unit* is well *trained* in avalanche search and rescue. They should also know how to use transceivers.
- *Check the snow stability* by digging Rutschblocks; do a blasting test to assess whether or not there is an avalanche hazard.
- Check that the *transceivers* are in the transmit position.
- Check that the *search equipment* is easily accessible.
- Keep at least 25–50 m between each soldier.
- Detail *guards* to check the area for signs of danger.
- Adjust *personal equipment* so that skis, poles and rucksacks can quickly be discarded.
- Use the hood of the snow jacket or a scarf to *protect nose and mouth*.
- Have each soldier string out a safety line and let it hang freely behind him.
- Carry *spades* (max. two men per spade).
- Carry *probes* (max. four men per probe).

The transceiver must be worn close to the body under the outer clothing and be in the transmit mode.

Safety Equipment

Safety equipment used in avalanche hazard areas is listed at the beginning of this chapter. In addition, everyone in the unit should have an *electronic transceiver* to facilitate search and rescue operations in case of an avalanche.

Training by a qualified instructor should always precede the use of safety equipment.

Considerations in Case of an Avalanche

When caught in an avalanche:

- Throw off skis, poles and other loose equipment.
- Try to escape! Try to hold onto a rock or a tree.
- Try to crouch, protect your face with your arms and make swimming motions.
- Remain calm and breathe as slowly as possible.

Rescue

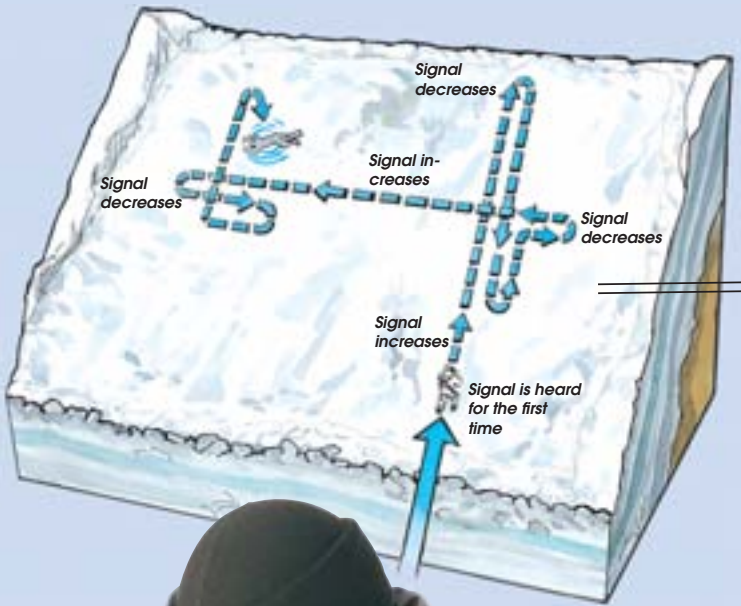
The use of the measures listed below depends on the number of people taking part in the rescue operations.

Search

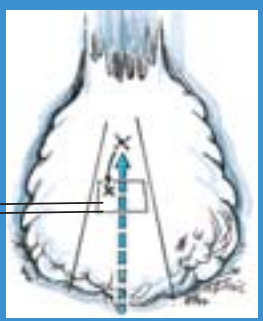
- *Make a note of where the victim was caught up in the avalanche* and where he was last seen.
- *Mark* these two places if possible.
- *Post a guard* to spot further avalanches and to call for help using the radio or a cellular phone. The guard should use signs and signals to alert other people in the area in order to increase the number of participants in the rescue operation.
- Look for *visible clues* such as the safety line.
- Begin searching where the victim was last seen. After that, begin a *systematic search* starting from the lowest part of the avalanche.

- If *transceivers* are being used, conduct the search in the picture. Make sure that transceivers are switched to 're-ceive'.

Fine Search

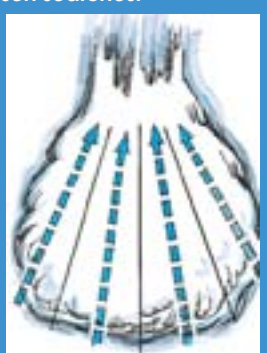


Methods for Rough Search using a Transceiver



Victim last seen; one person searches.

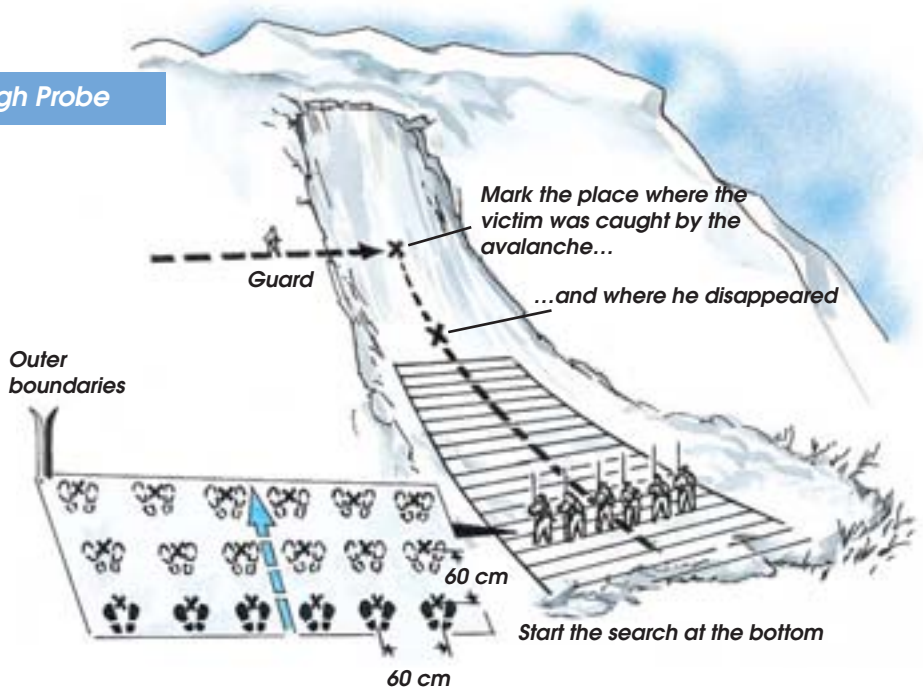
Not known where victim disappeared; one person searches.



Not known where victim disappeared; many people search.

- If there are no other aids, begin a *systematic rough search* (60x60 cm) using probes and poles (remove the handgrip or basket)
- *Push carefully* with the probe.

Systematic Rough Probe


Mark the place where the victim was caught by the avalanche...
Guard
...and where he disappeared
Outer boundaries
60 cm
Start the search at the bottom
60 cm

When the Victim Has Been Located

- Alert the commander. Begin digging at once.
- Uncover the victim's head and chest and begin first aid immediately while the victim is being dug out.
- Assume that the victim will be suffering from hypothermia and shock. Treat him with great care and consideration.
- Take the victim to the nearest doctor or hospital to get treatment.

When Qualified Help Arrives

- Begin an extensive fine probe search.
- *Teams with rescue dogs*, if available, start the search and the digging patrol follows them at a distance ready to start digging when signalled.

A rescue dog is the most effective way of searching.

Remember...

- The number of people available to search varies each time, which means that the search methods will vary.
- It is important to mark all places where equipment has been found and victims dug out. This facilitates the investigation of the accident.
- Soldiers suffering from shock after having escaped or been saved without physical injuries should be given something to do. Experience has shown that this has a positive effect on the soldiers because they have found it easier to recover mentally.

Appendix 1.
Avalanche Hazard Scale

Level of Hazard	Snowpack stability	Avalanche probability	Directions
1 Low	The snowpack is generally well bounded and stable.	Trigging is generally possible only with high additional load (2) and on a few very steep extreme slopes. Only a few small, natural avalanches possible.	Generally favourable conditions.
2 Moderate	The snowpack is moderately well bounded on some steep slopes (1), otherwise generally well bounded.	Trigging possible with high additional load (2) particularly on the steep slopes indicated in the Avalanche Bulletin. Large natural avalanches not likely.	Generally favourable conditions. Pay attention to local (1) hazard areas.
3 Considerable	The snowpack is moderately to weakly bounded on many steep slopes (1).	Trigging possible, sometimes even with low additional load (2). The Avalanche Bulletin indicates many slopes, which are particularly affected. In certain conditions, medium or large-sized natural avalanches may occur.	Movement requires avalanche hazard evaluation ability. Limited possibilities.
4 High	The snowpack is weakly bounded on most steep slopes (1).	Trigging possible even with low additional load (2) on many steep slopes. In some conditions, frequent medium or large-sized natural avalanches are likely .	Movement requires avalanche hazard evaluation ability. Very limited possibilities.
5 Very high	The snowpack is generally weakly bounded and largely unstable.	Numerous large natural avalanches are likely, even in moderately steep terrain.	Activities should be avoided in risk areas.

Note; 1) Generally described in more detail in the Avalanche Bulletin (e.g. altitude, aspect, type of terrain).

2) Additional load, '-high'; e.g. vehicle, party without unloading-distance, avalanche blasting. 'Low'; e.g. skier, party with unloading-distance.

'Steep slopes'; slopes with an incline of more than about 30°.
'Moderately steep slopes'; slopes with an incline of less than about 30°.
'- Steep extreme slopes'; particularly unfavourable in terms of the incline, terrain profile, proximity to ridge, smoothness of underlying gound surface.
'Natural'; without human interference.

Avalanche hazard evaluation ability: Military Mountain Guide or approved qualified personnel.

Avalanche Hazard Scale and Bulletins

In 1993 the European Avalanche Research Institutes agreed on a common model for *avalanche bulletins*. The model is based on a uniform *hazard scale* for avalanches to help remove the risk of misunderstandings when discussing bulletins between civilian and military authorities. This system, with its five hazard levels, has been used since 1998 by the Swedish Armed Forces.

At present, there is no similar civilian authority in Sweden. The Military Mountain Guide (MMG) is trained to carry out the work without civilian support. The purpose is to collect, review, present and follow-up the circumstances and developments that lead to actual hazards in each particular area. The information and the presentation are based on many years of international research and follow-up. The system provides a very good base for commissioned research and safety analyses for training.

The aim is to make a survey of the hazard zones, show where they are and state the critical degree of stress for the snowpack. An avalanche hazard area is terrain that contains potential release points, avalanche chutes and deposition areas. The risk of an avalanche increases exponentially with each hazard level.

The most important information is found in the criteria of each level of the *avalanche bulletin*.

In high-risk areas the snow pack is weak and the hazard area large. The amount of load required to release an avalanche decreases in high-risk areas.

Avalanche Hazard Scale – Expanded Definitions

Level 1, Low Hazard

- On the whole, the snow pack is very stable.
- Apart from small slides on extremely steep slopes, avalanches are possible, but very rare.
- Usually the conditions are favourable, even outside checked areas.
- The hazardous areas are very few and easy to detect. Generally, these areas are extremely steep and inaccessible.

Level 2, Moderate Hazard

- The snow pack is described as only moderately stable on certain steep slopes when the nature of the terrain, its profile, its exposition to the sun or wind and its altitude are taken into account.
- For the unit, the conditions are still favourable; however, local hazardous areas must be taken into consideration.
- The possibility of an avalanche cannot be ruled out, particularly if the areas mentioned in the bulletins are exposed to heavy loads or stress.

Level 3, Considerable Hazard

- On many steep slopes the snow pack is only moderately stable to unstable.
- An avalanche is possible at slight load and mainly in those areas outlined in the avalanche bulletins.
- The danger of a spontaneous release of an avalanche varies.
- Heavy snowfall or warming trends may cause moderate sized avalanches or one larger spontaneous avalanche.
- Activity outside checked areas requires avalanche prediction knowledge. An avalanche specialist should be in charge of the activity.
- This level is not to be seen as an average in the avalanche hazard scale.

Level 4, High Hazard

- On most of the steep slopes the snow pack is not well established and therefore, unstable.
- It is possible to release an avalanche with only slight load.
- Several moderately sized and single large spontaneous avalanches are possible. There is a risk of remotely released avalanches.
- Know how far the avalanche can reach in flat terrain.
- Roping off areas or artificial releasing of avalanches may be necessary to maintain activity in the area. Activity outside checked areas requires avalanche hazard evaluation ability.

Level 5, Very High Hazard

- The snow pack is generally weak and very unstable.
- Several large, spontaneous avalanches are possible.
- Extensive safety measures should be taken, like evacuations, roping offs and emergency warnings. Activity in these areas must only take place in an emergency.

Avalanche Bulletins

Together with the weather forecast, the avalanche bulletin provides a short-term survey of the snow conditions, the present avalanche hazard and the changes expected in the near future. The bulletin also provides general guidelines and instructions for a unit's activities. The avalanche bulletin consists of the following parts:

General Situation
It shows weather conditions during the last 24 hours and forecasts the weather for the next 24 hours.

Snow Pack Stability
It provides the general snow pack conditions in certain areas.

Evaluation of the Avalanche Hazard
It assesses hazard levels, which types of avalanche to expect, where the risk areas are and at what load an avalanche could be released.

Directions
The instructions provide information on assessed development, and give directions and motives for movements and activities.

Interpretation of the Avalanche Bulletin
The bulletin is valid for regional conditions and generally does not apply to other areas outside the region. The bulletin is issued on the basis of regional weather forecasts and therefore, it mainly follows the divisions made by the weather service. If no further directives are issued, it remains valid only for the current exercise or mission area.

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